MAMMAL SURVEY

OF

Northeastern Pennsylvania

FINAL REPORT

PITTMAN-ROBERTSON PROJECT 42-R

COMMONWEALTH OF PENNSYLVANIA

JOHN S. FINE, *Governor*

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OF

Northeastern Pennsylvania

BY

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AND

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PUBLISHED BY

PENNSYLVANIA GAME COMMISSION

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INTRODUCTION

The survey of the mammals of northeastern Pennsylvania is part of a more comprehensive, state-wide survey to obtain practical management information about the mammals of the Commonwealth; with particular reference to their life histories, ecology, range, abundance, habitat preferences, economic importance, and the effects of land use on their populations.

Studies of the mammals of northwestern Pennsylvania (Pittman-Robertson Project 20-R), southwestern Pennsylvania (Pittman-Robertson Project 24-R), northcentral Pennsylvania (Pittman-Robertson Project 37-R), and of southcentral Pennsylvania (Pittman-Robertson Project 38-R) have already been completed; and the survey of the mammals of southeastern Pennsylvania (Pittman-Robertson Project 43-R) has run concurrently with the present project.

The earliest comprehensive work on the mammals of the state was the *Mammals of Pennsylvania and New Jersey*, written by Samuel N. Rhoads and published in 1903. In 1928, Dr. Samuel H. Williams, who was then a member of the faculty of the University of Pittsburgh and a Pennsylvania Game Commissioner, published a more or less popular account of the mammals under the title *The Mammals of Pennsylvania*. The half century which has elapsed since Rhoads completed his field work has witnessed great changes in the mammalian fauna of the state; and our knowledge of the distribution of many forms has increased greatly in recent years. There are, however, still many gaps in our knowledge concerning even the most common species. It is hoped that the present survey will help to satisfy the need for more comprehensive and up-to-date information on a subject which is of great importance to sportsmen, trappers, and farmers; and which is of great interest to the ever-growing number of our citizens—both young and old—who find pleasure in the wild creatures of our fields and forests.

A number of other workers have conducted field studies on the mammals of northeastern Pennsylvania. Prominent among them have been Francis Harper, Earl L. Poole, John J. Christian, and Morris M. Green. The latter in 1930 published privately *A contribution to the mammalogy of the North Mountain region of Pennsylvania.*

Although this report is based primarily upon the field notes of the Project Leader and Assistant Project Leaders, everyone associated with the Project has contributed much in the way of information and suggestions. However, the responsibility for the information contained in this report, as well as the interpretations given it, is that of the writers, William C. Grimm, Project Leader, and Ralph Whitebread, Assistant Project Leader.

ACKNOWLEDGMENTS

The Survey of Pennsylvania Mammals in the Northeastern Sector, Pittman-Robertson Project 42-R, was conducted under the Federal Aid to Wildlife Restoration Act of 1937, and was administered jointly by the Pennsylvania Game Commission and the United States Fish and Wildlife Service.

The Survey of Pennsylvania Mammals was inaugurated through the efforts of Hon. Ross L. Leffler, President of the Pennsylvania Game Commission and Dr. J. Kenneth Doutt, Curator of Mammals, Carnegie Museum, Pittsburgh, Pennsylvania. The work of the Survey was planned and initially supervised by Dr. Doutt in his capacity as Supervisor, Special Personnel. He was also responsible for the taxonomic studies involved.

Neil D. Richmond, Field Supervisor, was responsible for the planning, supervision, and coordination of the field work with that of the other three parties.

Robert D. McDowell, Chief, Wildlife Research Division, Pennsylvania Game Commission, directed the project.

Miss Caroline Heppenstall, Assistant Curator of Mammals, Carnegie Museum, Pittsburgh, Pennsylvania, assisted with the identification of the specimens, and was responsible for the many details involved in receiving, handling, and caring for the collection of mammals and data as they were sent in from the field.

The field work was done by the Project Leader and one Assistant Project Leader. Mark L. Rutledge served as Assistant Project Leader from July 1, 1949 to October 31, 1950, when he entered the United States Army under the Selective Service Act. Ralph Whitebread was appointed Assistant Project Leader on November 1, 1950, and served in that capacity until the close of the project.

The following persons have served as Part Time Assistants at the Carnegie Museum, Pittsburgh, Pennsylvania, where they were engaged in the preparation of skeletal material or stenographical work: E. Hayden Moore, Jenette R. Tryon, Albert H. Bauer, John E. Guilday, Donald Mears, A. C. Lloyd, Eugene W. Gettig, Francis Gabig, Aenid Horton, and Sarah Morin.

To all who were directly associated with the project we wish to express our appreciation. In addition, we thank the following organizations and individuals:

The Pennsylvania Department of Internal Affairs, Topographic and Geologic Survey, for permission to use their map showing the physiographic divisions of Pennsylvania.

The United States Department of the Interior, Fish and Wildlife Service; the United States Department of Agriculture; the Pennsylvania Department of Agriculture, Bureau of Animal Industry; and the Pennsylvania State College, for their services and publications.

Mr. Carl C. Stainbrook, Supervisor of the Northeast Conservation Division, Pennsylvania Game Commission, and the various District Game Protectors under his supervision, for their interest and cooperation in the field work conducted under the project.

To the many individuals, too numerous to mention, who have supplied us with information and occasional specimens, we indeed owe a debt of gratitude.

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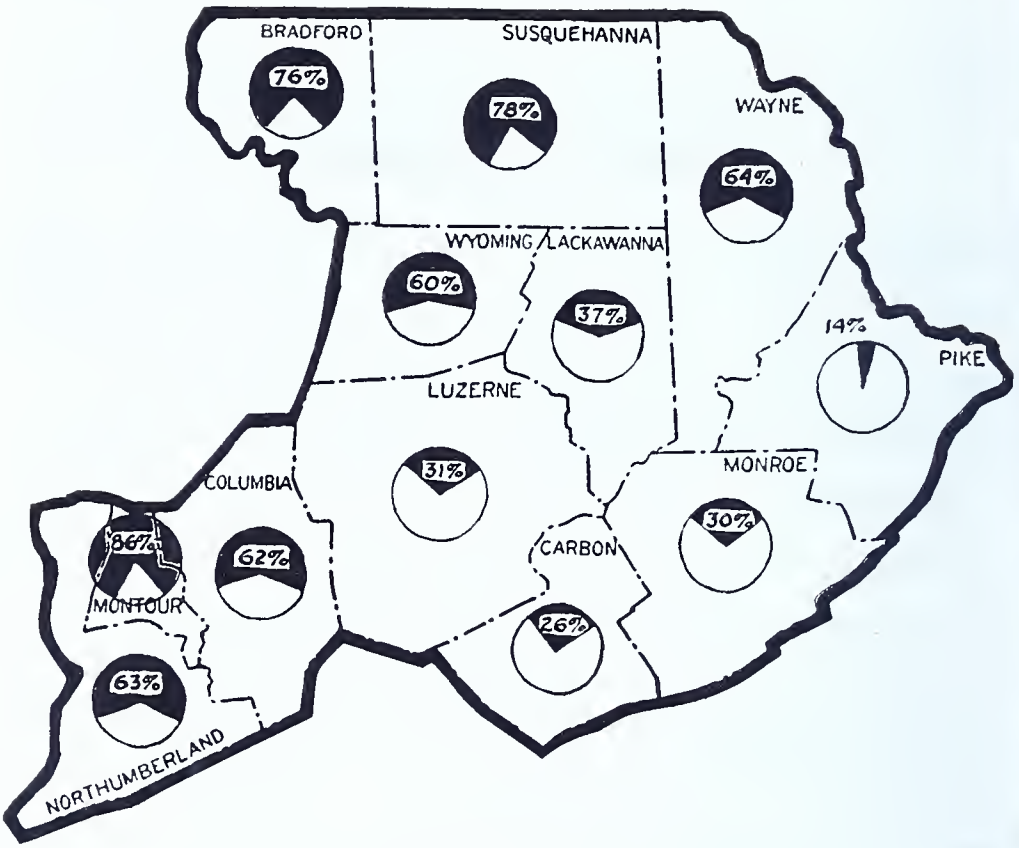

LAND USE MAP
(Per cent cropland in black)

HISTORY

Half a century ago Pennsylvania's wildlife resources were at their lowest ebb. The elk, bison, beaver, wolf, panther, marten, and fisher had become extinct; and even the white-tailed deer were so reduced in numbers that they had become somewhat of a novelty. The extensive and magnificient forests which once covered the state had all but disappeared; and each year fires ravaged the cut-over land, destroying the forest succession and devitalizing the very soil. We had come to the end of our era of plenty.

The succeeding twenty years saw the gradual development of organizations which were staffed and equipped to protect what little remained of our forest and wildlife resources. It was a tedious, uphill battle, for the general public had not as yet been awakened to the importance of conserving natural resources. The first efforts were devoted to protection, reforestation, and restocking; and it is evident today that these efforts were not without their reward. The hills and valleys of Pennsylvania are green again with a new forest holding a promise for the future. Wildlife has come back to the extent that Pennsylvania is again renowned for its small and big game hunting; and we have been taking a fur crop which, in recent years, has been worth from one to two million dollars annually.

Within the past twenty years new problems have arisen. There has been a tremendous increase in the number of hunters; and, in spite of the increase in the supply of game, it soon became apparent that protection and restocking alone could not possibly keep pace with the increasing demand. Today we realize that our wildlife habitats must be maintained at their maximum productivity; and out of this realization has grown the new science of wildlife management.

The management of any living thing, to the extent that its numbers can be increased or decreased at will, requires a thorough knowledge of its requirements for living. This is not a simple matter. It involves the management of a complex association of both plants and animals, as well as a knowledge of their interrelationships. It was for this reason that the assembling of existing data concerning the mammals of the state, and the conducting of field investigations where present knowledge is insufficient, was deemed to be desirable; such information is essential to the efficient management of our wildlife resources.

GENERAL DESCRIPTION OF THE AREA

The area covered by this survey includes in their entirety the counties of Carbon, Columbia, Lackawanna, Luzerne, Monroe, Montour, Northumberland, Pike, Susquehanna, Wayne, and Wyoming, and that portion of Bradford County lying to the east of the North Branch of the Susquehanna River—approximately 6,400 square miles. The highest point in this area is on North Knob, Herrick Township, Susquehanna County, with an elevation of 2,684 feet above sea level. There is a range of approximately 2,400 feet between this high point and the lowest elevation along the Delaware River, in Monroe County, at the Delaware Water Gap. Practically all of the area is hilly or mountainous, much of it with an elevation of 1,200 feet or more above sea level.

The first permanent white settlements were made in this region about two centuries ago, in the valleys of the Susquehanna and Delaware rivers. Today the greater part of the area is still sparsely populated and much of the land area is classified as forest land. The most densely populated areas are in the hard coal regions, particularly in the Susquehanna and Lackawanna River valleys. Scranton—now the fourth largest city in the state—Wilkes-Barre, and Hazelton are the most densely populated urban centers.

PHYSIOGRAPHY

Northeastern Pennsylvania is subdivided into two major physiographic provinces, as shown on the accompanying map (Fig. 1): (1) the Appalachian Plateau and (2) the Appalachian Valley provinces.

The Allegheny Mountains section of the Appalachian Plateau province extends northeastward into the western portion of Wyoming County, as far as the North Fork of the Susquehanna River where it culminates in the bold land masses of North and Dutch mountains. Geologists believe that these highlands, which in some places rise to nearly 2,600 feet, at one time may have been concordant with the crests of the Catskill and Adirondack mountains of New York State.

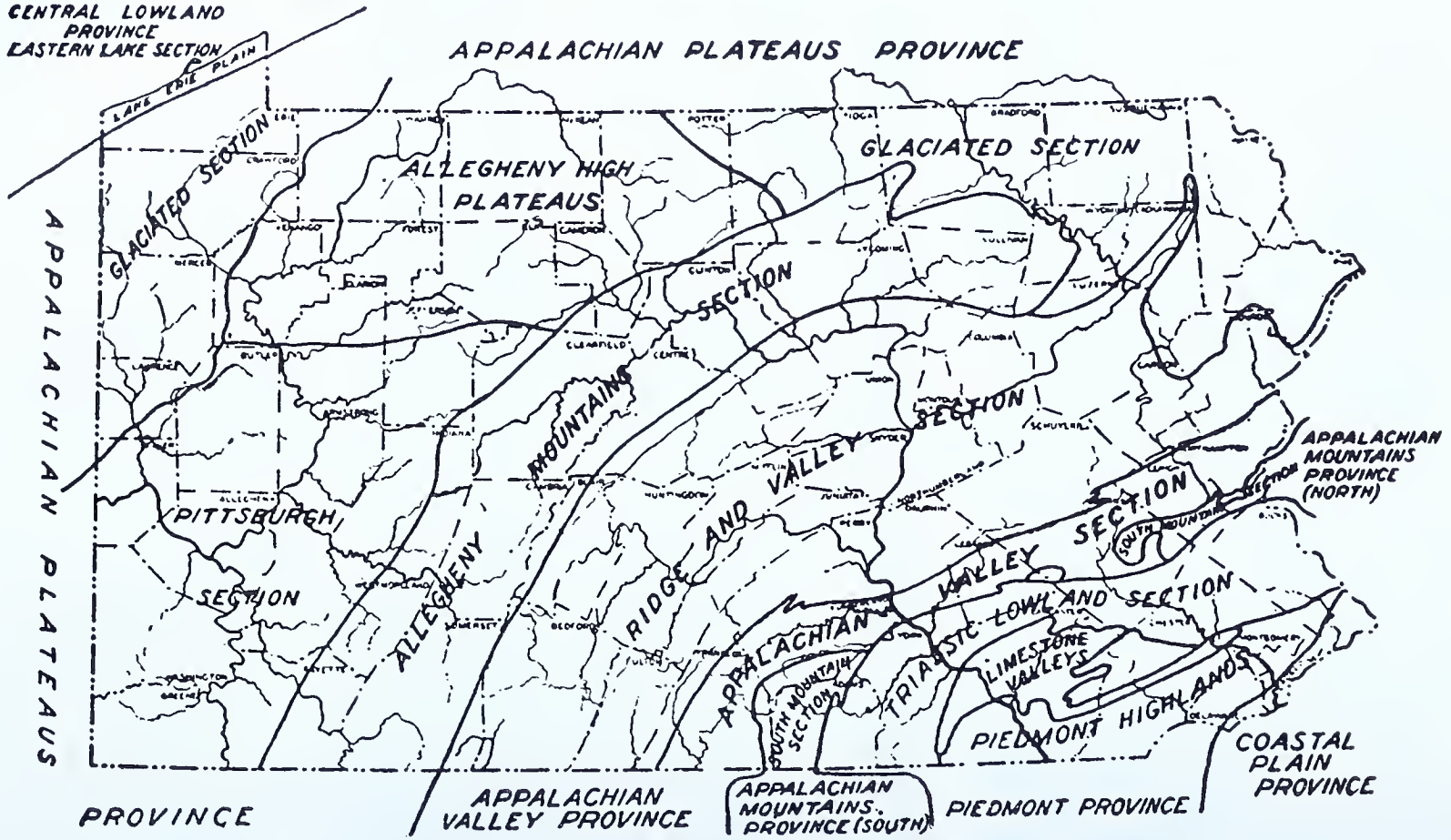

FIG. 1. PHYSIOGRAPHIC DIVISIONS OF PENNSYLVANIA

The eastern glaciated section of the Appalachian Plateau province extends entirely across the northern portion of northeastern Pennsylvania, as far south as the northern Luzerne, Carbon, and Monroe counties. "The Pocono Plateau, for example, is a nearly level highland 1,900 to 2,200 feet A.T., with shallow stream valleys and many lakes. This plateau is underlain by nearly flat-lying, hard Pocono sandstone. East of this highland in Wayne, Pike, and Monroe counties softer rocks have resulted in broad areas of accordant hilltops at a much lower level. The area is made up of irregular rounded hilltops separated by lakes and swamps, and, on the eastern margin, gorges into which the streams plunge from the plateau with numerous waterfalls. . . . The combination of hilly upland with its lakes, forests and swamps, the deep intersecting valleys, cool ravines, and the abundance of waterfalls makes this a favorite area for nature lovers.

"Swinging around the north end of the Northern Anthracite Field the surface changes. The broad uplands with their lakes are replaced with rounded stream divides and the area is minutely subdivided by deep valleys, many with broad bottom lands. The valleys of this area average about 600 feet deep. Lakes are not abundant: some of them are perched on the tops or flanks of hills. This area is dominated by the North Fork of the Susquehanna River" (Ashley, 1933).

The Ridge and Valley Section of the Appalachian Valley Province includes all but the northern portion of Columbia, Luzerne, Carbon, and Monroe counties and Montour and Northumberland counties in entirety. It also extends northeastward through Lackawanna County to the extreme southeastern corner of Susquehanna County in the form of a narrow arm roughly paralleling the Lackawanna River. This province is characterized by its many narrow and even-crested ridges which run more or less parallel in a northeast-southwest direction. According to Ashley (1933), "A striking feature of this area is the transverse direction of the river valleys and the deep water gaps where they cross the ridges. In places the ridges are so broken with gaps as to resemble a ruined wall." The famous Delaware Water Gap in the Kittatinny Mountain is renowned as a scenic attraction.

DRAINAGE

The divide between the Susquehanna and Delaware River drainage systems follows a general southwest to northeast course from the western edge of Carbon County, through Luzerne and Lackawanna counties, to the extreme northeastern part of Wayne County (Fig. 2). In most places this divide is almost imperceptible for it lies in the elevated, rolling, glaciated plateau which extends through these counties. Roughly two-thirds of the land area is drained by the North Branch of the Susquehanna River and its tributaries, and about one-third is drained by tributaries of the Delaware River. Susquehanna, Wayne, and Pike counties in particular are dotted with glacial lakes and swamps which are the sources of many of the streams. In the eastern part of

Susquehanna County, the Susquehanna River makes a bend down into Pennsylvania, flows northward into New York State again, and then reenters Pennsylvania in the northcentral portion of Bradford County some forty miles to the west.

The principal tributaries of the Susquehanna are: Wysox Creek in Bradford County; Wyalusing Creek in Bradford and Susquehanna counties; Meshoppen and Tunkhannock creeks in Susquehanna and Wyoming counties; the Lackawanna River in Susquehanna and Lackawanna counties; Wapwallopen and Nescopeck creeks in Luzerne County; Catawissa, Fishing, and Roaring creeks in Columbia County; and Shamokin and Mahanoy creeks in Northumberland counties.

The Lehigh River, which is a tributary of the Delaware, drains most of Carbon County and portions of Luzerne, Lackawanna, and Monroe counties. This stream drains practically the entire western portion of the Pocono Plateau.

Other important tributaries of the Delaware River, ranging from north to south are as follows: Equinunk Creek in Wayne County; the Lackawaxen River and Shohola Creek in Pike County; Bushkill Creek in Pike and Monroe counties; and Pocono Creek in Monroe County.

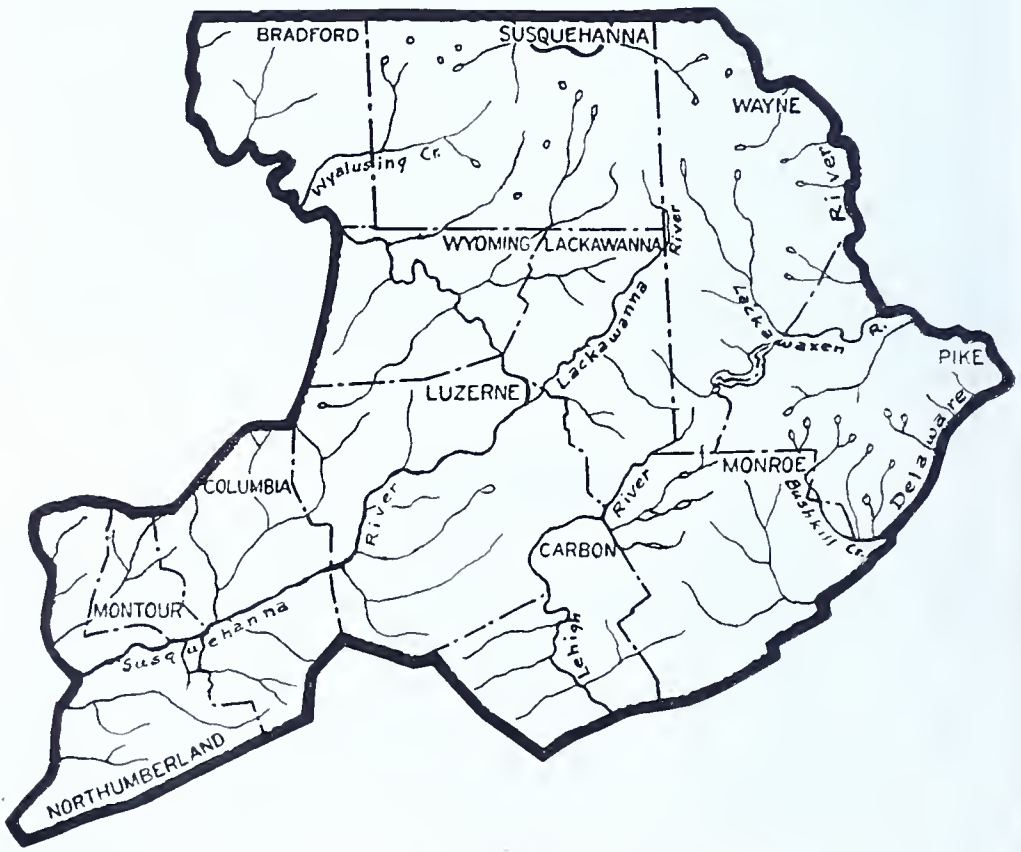

FIGURE 2. DRAINAGE PATTERN IN NORTHEASTERN PENNSYLVANIA

SOIL TYPES

Soils of northeastern Pennsylvania are of two general classes: those which have been derived from the native rocks, and those of glacial origin which may have been transported long distances by the great masses of ice which overrode the region. Over an extensive area there is a blanket of glacial till of variable thickness, but locally as much as 10 to 25 or more feet thick. It consists of an indiscriminate mixture of sand, clay, and boulders of various sizes. This glacial deposit is distinguished by the fact that it does not grade downward into the underlying rock, as residual soils do, and by the presence of foreign rock material.

The following discussion of the major soil types and the accompanying map (Fig. 3) have been adapted from the Yearbook of Agriculture for 1938 (U. S. Department of Agriculture).

Lackawanna-Culvers Area: The parent materials of these soils are glacial drift, composed largely of Indian-red and purplish sandstones

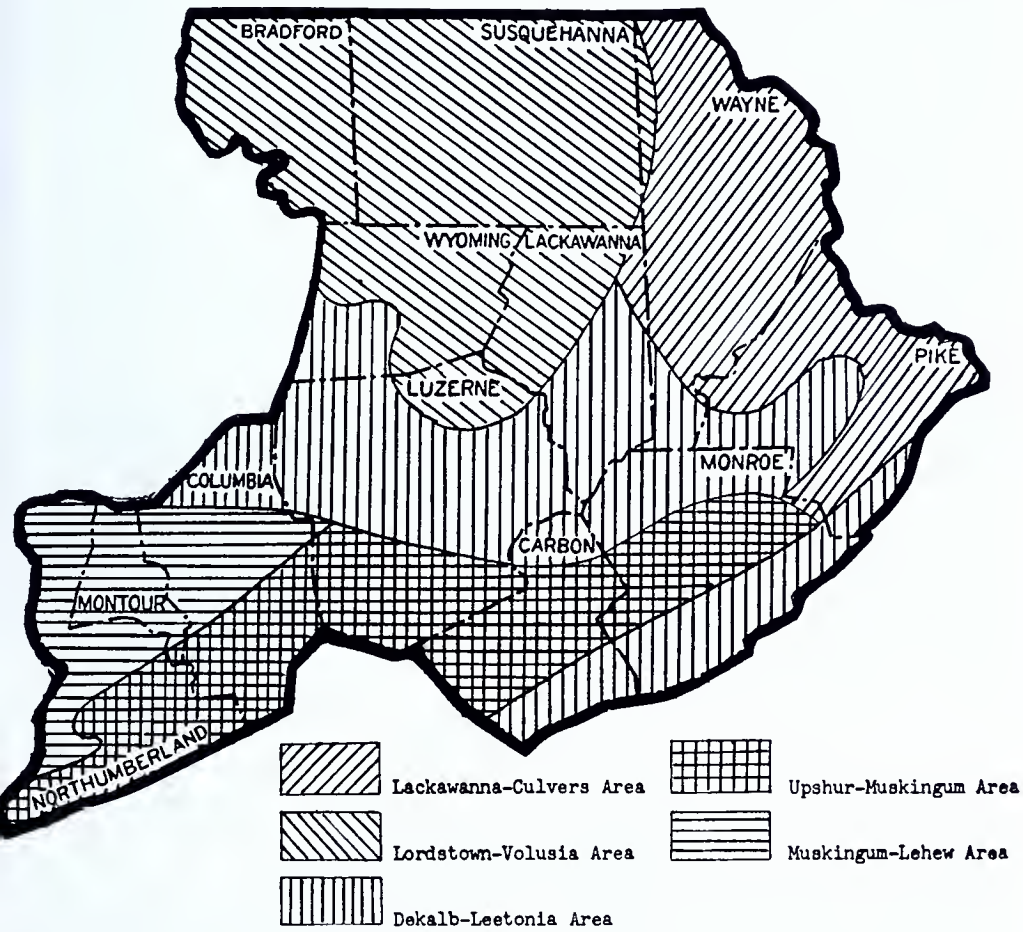

FIGURE 3. MAJOR SOIL TYPES

and shales with some gray sandstone and minor elements of other rocks. Lackawanna soils are weakly developed Podzols with organic mat, thin loamy surface soils and gravelly, loamy, or silty subsoils, composed of

glacial till, and with sandstone or shale bedrock 30 to 48 inches from the surface. Culvers soils are developed from similar materials but are imperfectly drained, and are mottled with gray and rust in the lower horizons. The latter occur on steep slopes. These soils give fair yields when they receive lime, manure, and complete fertilizers. Silage corn, hay, and pasture grasses are the principal crops grown on them.

Lordstown-Volusia Area: The parent materials of these soils are glacial till from gray sandstones and shales, with limestone in places. This till is thin on the plateau and upper valley walls and thick in the valleys. Much of the smoother, less stony land is under cultivation or in pasture; but large areas of steeper, stonier, or poorer lands are in forest. Common crops grown on these soils are timothy, clover, oats, buckwheat, silage corn, and potatoes.

Dekalb-Leetonia Area: The parent materials of these soils are weathered sandstones, shales, and conglomerates which are non-calcareous and highly acid. Dekalb soils are shallow, generally stony, and occur on sloping and steep lands. Leetonia soils are deeper and exhibit the typical Podzol profile. The latter occupy smoother plateau areas. Most of the land is too steep and stony for cultivation; but the better and more level areas are often cleared for hay meadow, pasture, or cropland.

Upshur-Muskingum Area: The parent materials of these soils are alternate thin beds of red calcareous and acid shales, gray shales, and sandstones of the "Coal Measures." Erosion is often active on the uplands, slips and slides probably doing the most damage. While much of the steeper land is in forest, on the more level areas these soils are extensively cultivated or pastured.

Muskingum-Lehew Area: This area comprises that portion of the Appalachian ridges in which red and gray shales are interbedded. The area is primarily made up of steeply sloping lands which form the sides of the ridges, in places dissected into a hilly or mountainous terrain. The soils are thin and have a reddish tint, except on the surface layer which is grayish-brown to a depth of 3 to 6 inches. Much of the land is stony. The usage of land in this area for cultivated crops is limited by the unfavorable relief and the shallowness and stoniness of the soils. Most of this land is in second-growth timber or brush.

CLIMATE

Rather pronounced local variations in climate are evidenced throughout the region, but in general the summers are short and cool, and the winters are long and cold. Temperatures of zero and below are recorded in most of the region every winter, but summer temperatures in excess of 90°F are quite unusual. In general the northernmost counties experience the most severe winters, coolest summers, and have shorter growing seasons than the counties in the southern portion of the region. Local variations in elevation also have a marked influence on climatic conditions; and microclimates, due primarily to air drainage, often result in well-defined local "frost pockets." Throughout most

of the region the daily temperature range is fairly large, often as much as 20°F in midwinter and 26°F in midsummer.

While it is true that the mountains of northeastern Pennsylvania are not rugged enough to have a true mountain type climate, they do have many of the characteristics of such a climate in a modified form. Notable differences in both daily temperatures and the length of the growing season are evident between the highlands and the valleys. For example let us take two localities in Monroe County, Mount Pocono and Stroudsburg, which are separated by an air line distance of about 12 miles but have a difference in elevation of about 1,400 feet. The average January temperature at Mount Pocono is 23.6°F while at Stroudsburg it is 27.3°F. During the winter season heavy snow often covers the ground at Mount Pocono while the ground may be quite bare at Stroudsburg; and ice storms often occur at the former place when freezing conditions are not experienced at the latter. In July the average temperature at Mount Pocono is only 65.7° while at Stroudsburg it is 71.8°. Growing seasons on the Pocono Plateau are much shorter than they are in adjoining lowlands; varying from a mere 115 days at Gouldsboro to 127 days at Mount Pocono. On the other hand the growing season ranges from 144 days at Stroudsburg to 176 days at Scranton. These differences are quite apparent in the spring when such cultivated shrubs as the golden-bells *(Forsythia)* bloom a full two to three weeks earlier in the lowlands than on the Pocono Plateau, and again in the autumn with the much earlier advent of killing frosts in these highlands. At Gouldsboro the average date for the last killing frost in the spring is May 26 and that for the first killing frost in the fall is September 18. Heavy-to-killing frosts are not unusual, however, in both June and August in frost pockets.

Precipitation seems to be somewhat heavier on the Pocono Plateau than elsewhere in the region, and lightest in the Susquehanna Valley. At both Freeland and Mount Pocono the average annual precipitation is approximately 49 inches while at Wilkes-Barre and Scranton it is between 37 and 38 inches. In the valley of the Delaware River, it falls between these two extremes: 46 inches at Stroudsburg and 42 inches at Milford, Pike County. During the summer season most of the precipitations occurs as thundershowers, and in winter a great deal of it falls as snow. The seasonal snowfall averages in excess of 50 inches in the northern counties, on the Pocono Plateau, and in other highland areas. The ground is normally covered with snow about three-fourths of the time during the winter season.

NATIVE VEGETATION

When settlement of northeastern Pennsylvania began during the eighteenth century, virtually the entire land area was heavily forested. In the north there were dense stands of sugar maple, beech, birch, cherry, chestnut, white ash, white pine, and hemlock. The central and southern sections were covered with a mixed forest of oaks and chestnut with beautiful stands of white pine and hemlock in the cool, moist

ravines. Along the ridges grew a forest dominated by the rock-loving chestnut oak. Even in those days, there were sizeable acreages of scrub oak in western Monroe County and eastern Carbon County and scattered bog areas which were nearly or quite devoid of tree growth; but elsewhere the early settlers found an almost unbroken expanse of very fine timber trees.

Although man has brought about vast changes in the native vegetation by clearing the land for crops and pasture and by permitting fires to ravage the cut-over forest areas, all of the original forest types may still be found in the region. Some of them, of course, have been greatly diminished in area, while others have been vastly expanded by the direct or indirect activities of man. Fig. 4 shows the present distribution of the seven major forest types, or associations, based on surveys of the Allegheny Forest Experiment Station.

The *beech-birch-maple forest type* occupies an extensive area in the northern portion of the region, where it almost exclusively occupies the glaciated highlands. The dominant trees are the sugar maple *(Acer saccharum)*, red maple *(Acer rubrum)*, beech *(Fagus grandifolia)*, and yellow birch *(Betula lutea)*. The white ash *(Fraxinus americana)*, wild black cherry *(Prunus serotina)*, and basswood *(Tilia americana)* frequently occur as associates; and the hemlock *(Tsuga canadensis)* often occurs abundantly in ravines, or about the lakes and swamps. Characteristic understory shrubs or small trees include the striped maple *(Acer pennsylvanicum)*, mountain maple *(Acer spicatum)*, hobblebush *(Viburnum alnifolium)*, and the large-leaved holly *(Ilex montana)*. When in leaf this type of forest casts a deep shade, and the understory, except for the tolerant seedlings of the dominant trees, is often sparse. This is particularly true of the younger stands. As a rule there is an amazing variety of early flowering, herbaceous plants; but, in the summer aspect, various ferns and clubmosses often constitute the dominant ground cover.

The glacial soils occupied by the beech-birch-maple forest are generally very stony, but in Wayne, Susquehanna, and eastern Bradford counties large areas of this forest have been cleared to make way for cropland and pasture. A striking feature of the landscape in the more rugged sections is the rocky pasture field with its almost circular patches of hay-scented fern *(Dennstaedtia punctilobula)*.

Wherever the beech-birch-maple forest has been cut over and the land repeatedly burned, it is almost invariably replaced by the *aspen-gray birch-pin cherry type*. This is a subsere or developmental stage forest comprised of short-lived trees, and, barring recurrent fires, it is eventually succeeded by the beech-birch-maple forest. The dominant

trees are the trembling aspen *(Populus tremuloides)*, gray birch *(Betula populifolia)*, and the pin or fire cherry *(Prunus pennsylvanica)*. There are often remnants of red maple *(Acer rubrum)*, wild black cherry *(Prunus serotina)*, beech *(Fagus grandifolia)*, and occasionally other species from the beech-birch-maple type. These become increasingly dominant as the forest grows older. Prominent among the understory shrubs are the sheep laurel *(Kalmia angustifolia)*, meadowsweet *(Spiraea latifolia)*, witherod *(Viburnum cassinoides)*, and various blueberries including the highbush blueberry *(Vaccinium corymbosum)*. This forest type is prevalent and very conspicuous in the North Mountain region and over a large area on the Pocono Plateau in Monroe County.

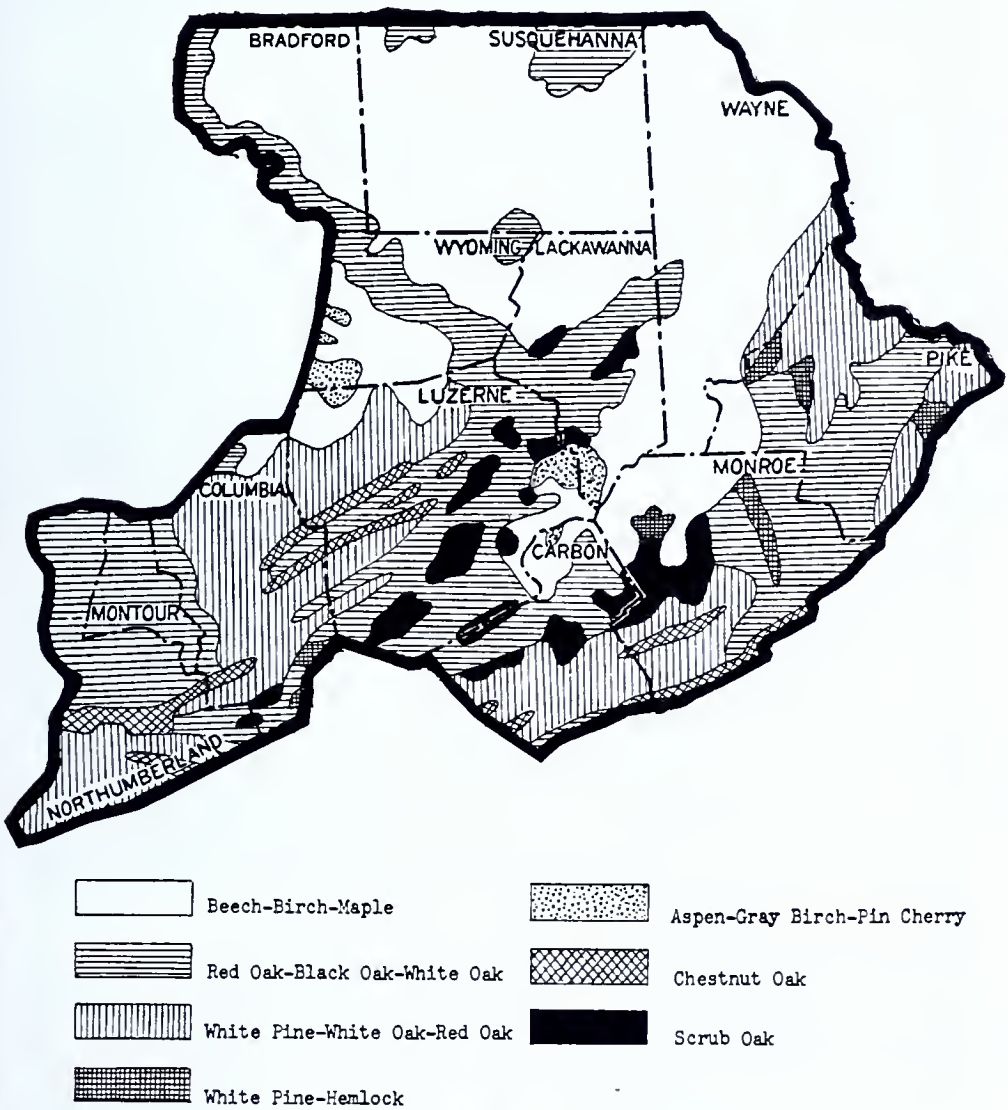

FIGURE 4. MAJOR FOREST TYPES
(Based on surveys by the Allegheny Forest Experimental Station)

The *white pine-white oak-red oak forest type* is characteristic of the fairly moist, fertile, and rolling country of the foothills. It is the prevailing type of forest in Columbia and western Luzerne counties, in the Blue Mountain Valley, and in southern Northumberland and southeastern Pike counties. The white pine *(Pinus strobus)* seldom occurs in pure stands, usually being well interspersed with northern red oak *(Quercus rubra)*, black oak *(Quercus velutina)*, white oak *(Quercus alba)*, red maple *(Acer rubrum)*, tulip tree *(Liriodendron tulipifera)*, beech *(Fagus grandifolia)*, and white ash *(Fraxinus americana)*. On the drier sites the chestnut oak *(Quercus prinus)* and pitch pine *(Pinus rigida)* often occur as associates. Among the common understory shrubs are the mountain laurel *(Kalmia latifolia)*, sheep laurel *(Kalmia angustifolia)*, witch hazel *(Hamamelis virginiana)*, spicebush *(Lindera benzoin)*, maple-leaved viburnum *(Viburnum acerifolium)*, flowering dogwood *(Cornus florida)*, and the rhododendron *(Rhododendron maximum)*. A great deal of the area originally occupied by this forest type has been cleared for farms.

The *red oak-black oak-white oak forest type* is the characteristic forest along the slopes of the ridges, the river hills bordering the Susquehanna, and on the comparatively level and fertile land of Montour and Northumberland counties. The dominant trees are the northern red oak *(Quercus rubra)*, black oak *(Quercus velutina)*, and white oak *(Quercus alba)*. The more common associates include the red maple *(Acer rubrum)*, white ash *(Fraxinus americana)*, basswood *(Tilia americana)*, shag-bark hickory *(Carya ovata)*, and pitch pine *(Pinus rigida)*. The principal understory shrubs and small trees include the mountain laurel *(Kalmia latifolia)*, sheep laurel *(Kalmia angustifolia)*, black huckleberry *(Gaylussacia baccata)*, early low blueberry *(Vaccinium angustifolium)*, late low blueberry *(Vaccinium vacillans)*, witch hazel *(Hamamelis virginiana)*, maple-leaved virburnum *(Viburnum acerifolium)*, flowering dogwood *(Cornus florida)*, and sassafras *(Sassafras albidum)*.

The *chestnut oak forest type* is confined to the dry and extremely rocky sites along the crests and southern slopes of the mountain ridges. It occurs principally along the Blue Mountain and other ridges in the southern part of the region. The chestnut oak *(Quercus prinus)* is the dominant tree, but associated with it are other species of oaks, red maple *(Acer rubrum)*, black gum *(Nyssa sylvatica)*, and pitch pine *(Pinus rigida)*. The mountain laurel *(Kalmia latifolia)*, sweet fern *(Comptonia peregrina)*, black huckleberry *(Gaylussacia baccata)*, late low blueberry *(Vaccinium vacillans)*, and sassafras *(Sassafras albidum)* are among the commoner understory shrubs or small trees.

The *scrub oak forest type* occurs at higher elevations on soils which are thin, poor, and usually rocky. There are extensive areas of so-called scrub oak "barrens" in Carbon, Monroe, Luzerne, and Lackawanna counties. It is a temporary forest type which is evidently created and maintained by recurrent fires on areas which otherwise would be occupied by the other types of oak forest. There is historical evidence that substantial acreages of scrub oak have existed on the Pocono Plateau in Monroe and Carbon counties for a very long time. Some of

the soldiers in Sullivan's expedition, who traversed this region almost two centuries ago, recorded in their diaries the fact that scrub oak "barrens" existed even then. However, many of the areas now occupied by scrub oak are of much more recent origin. Scrub oak *(Quercus ilicifolia)* is the dominant species of woody vegetation, but common associates are sassafras *(Sassafras albidum)*, pitch pine *(Pinus rigida)*, sweet fern *(Comptonia peregrina)*, early low blueberry *(Vaccinium angustifolium)*, and sheep laurel *(Kalmia angustifolia)*. Where fire has been excluded for some time various other species of oaks appear, and eventually they overtop the scrub oak. Generally this type forms a very dense ground cover.

The *white pine-hemlock forest type* occurs on moist to well-drained slopes and in cool, moist ravines. The dominant species are the white pine *(Pinus strobus)* and the hemlock *(Tsuga canadensis)* mixed in variable proportions. The principal associate species are the red maple *(Acer rubrum)* and yellow birch *(Betula lutea)*. Characteristic understory shrubs and small trees include the Canada yew *(Taxus canadensis)*, hobblebush *(Viburnum alnifolium)*, mountain maple *(Acer spicatum)*, striped maple *(Acer pennsylvanicum)*, and the large-leaved holly *(Ilex montana)*. The understory of woody plants is often very sparse, particularly where the dominant trees occur in a close stand. Various ferns and clubmosses are usually the most abundant green plants on the forest floor which not infrequently is covered only with a mat of fallen needles. This forest type originally was far more extensive than at present. It was the most valuable type of forest to the eyes of the pioneer lumberman. A few virgin stands still survive, most of them in park areas or on private preserves.

In addition to the seven major forest types which have already been discussed, the following deserve at least mention. Along the Susquehanna and Delaware rivers, and often for some little distance up their tributary streams, there is the *river birch-sycamore forest type*. It is characterized by the dominance of river birch *(Betula nigra)*, sycamore *(Platanus occidentalis)*, silver maple *(Acer saccharinum)*, American elm *(Ulmus americana)*, and black willow *(Salix nigra)*. Such a forest occupies the river banks and the broad, alluvial floodplains. As one ascends the smaller streams into the hills the forest characteristically becomes that of the *hemlock-birch-rhododendron type*. It is composed chiefly of hemlock *(Tsuga canadensis)*, yellow birch *(Betula lutea)*, black birch *(Betula lenta)*, and red maple *(Acer rubrum)* with a more or less dense understory of rhododendron *(Rhododendron maximum)*. The latter type is that found along practically all of the fast-flowing, rocky-bedded, and cold mountain streams.

On the Pocono Plateau, North Mountain, and elsewhere at high elevations, the red spruce *(Picea rubens)* often is a dominant tree, and in a few places it forms practically pure stands. It is characteristically a Canadian type of forest and occupies local cold "pockets" on moist to well-drained, thin, and often very rocky soils. There are also many typical bog areas, ranging from floating mats over the open water of lakes and ponds to depressions where the filling has been nearly or quite complete. Such areas are very wet, with a deep carpet of

sphagnum moss, and they possess a very distinctive vegetation. Among the characteristic woody plants are the black spruce *(Picea mariana)*, tamarack *(Larix laricina)*, balsam fir *(Abies balsamea)*, leatherleaf *(Chamaedaphne calyculata)*, Labrador tea *(Ledum groenlandicum)*, bog rosemary *(Andromeda glaucophylla)*, pale laurel *(Kalmia polifolia)*, purple chokeberry *(Pyrus floribunda)*, and cranberries *(Vaccinium macrocarpon* and *V. Oxycoccos)*.

LAND USE

Forest Industries: Originally the forest covered practically all of northeastern Pennsylvania. Even today better than 60% of the region is classified as forest land (Fig. 5), but much of the forest is unproductive because of destructive lumbering and recurrent forest fires. The farmers who first settled in this region during the eighteenth century had to cut the timber to clear land for crops and pasture. During the nineteenth century the lumber industry had its heyday; the felling of hemlocks for tanning bark and of pines for construction lumber greatly reduced the volume of softwood timber. At the close of this century the sawlog-size white and pitch pines of the northeastern counties were almost entirely gone, and sawmill operators began to fell the mixed stands of hardwoods. Meanwhile the growing anthracite industry was making inroads on the stands of oak timber near the mines.

According to Ineson and Ferree (1948), "By the first decade of the present century the forests were greatly reduced. Only a few virgin stands remained, in inaccessible areas and in recreational preserves. In the neighborhood of the mines second-growth oak stands were being clear-cut for mine timbers. Fires became more frequent and more destructive, especially near the mines, and in Pike and Monroe counties. Except for an increase in scrub oak and aspen, however, the type distribution of the original forests remained unchanged."

The same authors point out that forest products industries accounted for only 4% of the region's basic income in 1940, and for less than 2% of all employment in the anthracite region in 1945. At present four-fifths of the expenditure for forest raw materials used by manufacturing industries goes outside of the region. Few of them depend entirely, or even largely, on local forest products. Yet practically all of the raw materials which are used in the region could have been produced locally if the forests had been properly managed over the past years. The majority of the commercial sawmills now in operation are in Susquehanna, Wayne, and Pike counties.

In all of the counties of northeastern Pennsylvania there is a considerable acreage of land which has proved unfit for crops and even for grazing; consequently it has been abandoned and permitted to revert to forest. The reversion has taken place very slowly on some areas and, even where it has been rapid, the resulting forest stands are often of a poor quality.

Mining: Coal mining is the keystone in the economy of most of northeastern Pennsylvania, accounting for 41% of the basic income of the region in 1940. The greatest concentration of population is in the

coal fields, which, for the most part, are in the valleys of the Susquehanna and Lackawanna rivers. Forest lands in the vicinity of the coal fields have been severely abused. Mine waste banks cover thousands of acres of the land, and tons of silt are washed from the mine dumps into the valley bottoms, resulting in the extensive silting of the streams. The U. S. Army engineers estimate that each year a million tons of mine waste enter the Schuylkill River alone, and that 30% of this comes from the surface waste banks. The past twenty years have witnessed a great increase in the surface stripping of coal, and, as a result, thousands of acres of potential forest land have been stripped of their soil and trees. According to Ineson and Ferree (1948) strip-mined areas, together with the mine waste dumps, cover approximately 100,000 acres of land in the Anthracite Region in Pennsylvania.

Agriculture: The decrease in farm acreage between 1900 and 1940 was highest in Luzerne, Carbon, Monroe, and Pike counties where it amounted to 35% or more, and least in Montour County where it amounted to less than 15%. In Wayne, Susquehanna, Bradford, Wyoming, Columbia, and Northumberland counties the decrease has amounted to between 15% and 25% (Wrigley, 1946).

The northeastern dairy area includes Wayne, Susquehanna, Bradford, and parts of Lackawanna and Wyoming counties. In this region much of the land area is rough and stony, or poorly drained, although some good crop land occurs in many of the valley bottoms. Farmlands are well interspersed with tracts of woodland. Hay is the most important crop followed by oats and silage corn. Although dairying predominates throughout the area, the raising of poultry is an important secondary enterprise in many places. New York City provides the principal market for the milk produced, but Scranton and Wilkes-Barre are also important local markets for milk and other farm products. General farming is more prevalent near the densely populated coal fields. The prosperous appearance of many of the farms in northeastern Pennsylvania, however, is not due so much to the productivity of the land as to income gained from summer boarders. As a matter of fact, a high percentage of the farmland is very definitely in the submarginal category.

Recreation: The extensive forest lands, numerous lakes, and mountain streams of northeastern Pennsylvania—coupled with the fact that they are within comparatively easy travelling distance of populous cities in New York, New Jersey, and southeastern Pennsylvania—have made this region a very popular vacation land. While a great deal of the recreational development has been of a very exclusive type, there are sizeable tracts of publicly owned lands which are scattered throughout the region. The Department of Forests and Waters administers extensive State Forests in Pike County with smaller blocks in Monroe, Lackawanna, and Wyoming counties, as well as large State Parks in Monroe, Carbon, and Luzerne counties. The Pennsylvania Game Commission alone has nearly 160,000 acres of State Game Lands in the region covered by this report. In many sections, recreational activities at present provide the principal source of income. This is particularly true in the Poconos of Monroe County, but it is of no small significance

in Pike and Wayne counties as well. The region not only attracts large numbers of summer visitors and campers, but it is a popular mecca for anglers and hunters who come from a wide radius.

ECOLOGICAL DISTRIBUTION OF MAMMALS

For some years an attempt has been made to explain the distribution of birds and mammals on the basis of Merriam's life-zone concept, and life-zone maps have usually accompanied most regional fauna reports. This concept is based upon two factors governing the distribution of animal life: temperature and humidity; temperature is regarded as the more important of the two factors involved. Three of these life zones have been defined in the present region (Williams, 1928), and are shown on the faunal maps of the State. The Canadian Zone occurs throughout the glaciated uplands from Monroe County northward, including the North Mountain region; while the region to the southward is considered as belonging to the Alleghenian Faunal Area of the Transition Zone. The Carolinian Faunal Area of the Upper Austral Zone occurs here as a narrow band along the Susquehanna and Delaware rivers in the southern part of the region.

Elements of the Canadian Zone are far better represented in northeastern Pennsylvania than in most other parts of the State, and this zone originally was undoubtedly much more extensive and better defined than it is at the present time. Typically the Canadian Zone is characterized by a boreal forest of such coniferous trees as spruce and balsam fir, but the growth of these species is no longer extensive in the region. The largest remaining stands of spruce are found on the Pocono Plateau and on North and Dutch Mountains in Luzerne and Wyoming counties. There are, however, numerous small bogs throughout the region where spruce and balsam fir still flourish, but they constitute mere islands in an otherwise predominantly deciduous forest of maples, birches, and oaks.

The Canadian Zone, in this region today, is better represented by typical breeding species of birds than it is by typically Canadian Zone mammals—for example, the hermit thrush, white-throated sparrow, purple finch, Nashville warbler, northern water-thrush, and the red-breasted nuthatch. The only species of mammals which appear to be more or less strictly confined to areas with a typically Canadian Zone aspect are the rock vole *(Microtus chrotorrhinus)* and possibly the water shrew *(Sorex palustris)*. The long-tailed deer mice *(Peromyscus maniculatus)*, northern flying squirrel *(Glaucomys sabrinus)*, gray long-tailed shrew *(Sorex dispar)*, red-backed mouse *(Clethrionomys gapperi)*, porcupine *(Erethizon dorsatum)*, and the Bonaparte's weasel *(Mustela erminea)* are apparently more abundant in this zone, but all of them occur elsewhere in typically Alleghenian areas.

As with the Canadian Zone, the Carolinian Faunal Area is better represented here by typically Carolinian birds than it is by mammals. Cardinals, tufted titmice, and yellow-breasted chats are found along the Susquehanna River as far north as Bradford County, and along the

Delaware as far north as Pike County; but they are rarely if ever encountered anywhere in the adjacent highlands. The only mammals which might be considered, even remotely, as Carolinian species are the opossum and the gray fox, but they have spread out over the entire region and are now not uncommon even in typically Canadian Zone habitats. The Carolinian Fauna is, in fact, very poorly represented in the present region.

In recent years many workers have found fault with Merriam's life-zone concept, and an attempt has been made to fit the distribution of animals into a biome concept. Biomes are climax plant and animal communities. According to Clements and Shelford (1939), "The extent and character of the biome are exemplified in the great landscape types of vegetation with their accompanying animals, such as grassland or steppe, tundra, desert, coniferous forest, deciduous forest, and the like. These commonly represent biotic formations or climaxes, which in their general features have been noted by naturalists since the early days of biology. Each of these consists of a great biotic complex of fully developed and developing communities. The mature mass is the final expression of the response of communities to climate." Under the biome concept the greater part of the region would fall quite naturally into the Coniferous-Deciduous Forest Ecotone—a broad transitional band between the northern Coniferous Forest Biome and the more southerly Deciduous Forest Biome; but locally there are areas, now not very extensive, which are certainly typical of the true northern coniferous forest.

Habitat niches seem to be of more importance locally in determining the distribution of many mammals than is temperature or humidity. Meadow mice, for instance, are apt to occupy a grassy habitat niche in either life zone or biome, their optimum habitat unmowed meadows and swale areas where there are rank growths of grasses, sedges, and other herbaceous plants. These mammals are often found in swale areas, old beaver meadows, or about the grassy borders of ponds even when they are isolated for many miles by forested land.

Seldom are characteristically forest-inhabiting species uniformly distributed through a forested area. The red-backed mouse is usually abundant only where the forest floor is strewn with rocks and fallen logs and abounds with ferns; and the gray long-tailed shrew occurs only where deep, subterranean passageways occur among the rocks. Such a habitat is occupied by the rock vole, but it apparently does not exist in many of the habitats which appear to be optimum. There often seems to be some unknown and perhaps complex combination of factors in the habitat niche which determines its habitability for a given species.

A few species of mammals seem to be perfectly at home in an exceedingly wide variety of habitat niches. Thus the short-tailed shrew *(Blarina brevicauda)* undoubtedly has the widest distribution of any of our native mammals. It occurs commonly in an amazing variety of habitats, ranging from dense coniferous forest to open fields, in both moist or dry situations, and at all conceivable altitudes. We know of no terrestrial habitat niche in which this mammal is at all times absent,

aside from a strictly aquatic one; and it has, on occasion, been taken on floating bog mats over the open water.

Man has materially influenced the distribution of most species of mammals through his alteration of the environment. Originally forest habitat was predominant in this region, and a large part of it was covered with a virgin stand of huge trees: white pine, hemlock, red spruce, and various hardwoods. Such a forest provided a cool, moist habitat with a deep layer of humus and leaf litter and an abundance of fallen trunks and standing den trees. Today this virgin forest is virtually non-existent, and, although much of the land area may still be classified as forest land, the trees are mostly small, often merely brush, and the stand is entirely different in its composition. Generally speaking, a much warmer and drier habitat resulted when the virgin forest was removed, and the fires which invariably followed lumbering operations made even more drastic changes in environmental conditions. Hence, when the extensive forest habitat of such species as the fisher, pine marten, and Canada lynx disappeared, these animals simply had to follow it into oblivion, and other species like the opossum, gray fox, and cottontail rabbit, which were favored by the change brought about in the forest habitat, naturally increased and supplanted them.

Man's agriculture has resulted in a complete change from the forest environment, bringing into the region open grassy pastures and meadows and crop fields with various grains and weed seeds. This has quite naturally favored certain species of mammals—for example, the woodchuck, cottontail rabbit, and meadow mouse. While all of these animals were undoubtedly present in the region in primeval times, their optimum habitat was extremely limited and local; and they were certainly much less common than they are at the present time. There is some evidence that the prairie deer mouse *(Peromyscus maniculatus bairdii)* is a rather recent newcomer. It is typically a midwestern species of the prairie or Grassland Biome, and within comparatively recent years it apparently has followed suitable man-made habitats eastward into this originally forested region. Man has removed the barriers and favored an expansion of its range.

METHODS AND PROCEDURES

Field work in northeastern Pennsylvania was begun in July, 1949 and completed in June, 1951. An effort was made to include as many different ecological types as possible. Study areas were chosen to give the greatest possible coverage of the area and, at the same time, to provide sample areas with outstanding topographical features. The major drainage pattern and the differences in altitude were important factors taken into consideration. Each of these study areas was intensively trapped.

Permanent headquarters for this survey was located at Pocono Lake, Monroe County. Work in this area was largely confined to the winter seasons and to brief intervals between moving from field headquarters in the summer months. The other areas were studied during the spring.

	Forest	*Brush*	*Grass & Weeds*	*Water*	*Factors Apparently Essential or Preferred In the Habitat*
Opossum	X	X			Bottomlands and rocky places preferred
Hairy-tailed Mole	X	X	X		Well drained to dry soils.
Star-nosed Mole	X	X	X		Moist to saturated soils
Masked Shrew	X	X	X		Cool, moist habitat preferred
Big-tailed Shrew	X				Presence of cool, moist crevices in rock
Smoky Shrew	X	X	X		Cool, moist, and rocky places preferred
Little Short-tailed Shrew			X		Short grass or bare soil
Short-tailed Shrew	X	X	X		None
Water Shrew	X	X		X	Fast-flowing, rocky-bedded streams
Black Bear	X	X			Extensive forests
Raccoon	X	X			Hollow trees or crevices in rocks
Short-tailed Weasel	X	X			Presence of stumps, logs, or rock piles
Long-tailed Weasel	X	X			Presence of stumps, logs, or rock piles
Mink				X	Streams or ponds, but wanders widely
Otter				X	Presence of lakes, ponds, or streams
Skunk	X	X	X		Prefers forest edge and brushland
Red Fox	X	X			Prefers broken forest and brush
Gray Fox	X	X			Dense woods, brush, and rocks
Bobcat	X	X			Dense woods, brush, and rocks
Woodchuck	X	X	X		Presence of succulent vegetation
Chipmunk	X	X			Presence of stumps, brush, or rocks
Red Squirrel	X				Prefers coniferous woods
Gray Squirrel	X				Prefers oak-hickory woods
Eastern Flying Squirrel.	X				Prefers oak-hickory woods
Mearns' Flying Squirrel	X				Prefers mixed coniferous-deciduous woods
LeConte's Deer Mouse.	X				Cool, moist, and rocky sites
Prairie Deer Mouse			X		Dry exposed sites with scanty vegetation
Fischer's Deer Mouse..	X	X			Wooded or semi-wooded areas of any type
Wood Rat	X	X			Rocky cliffs and slide rock
Lemming Mouse			X		Moist to dry sites with grassy cover
Red-backed Mouse	X	X			Cool, moist, and rocky areas preferred
Meadow Mouse			X		Grasses and sedges; moist areas preferred
Rock Vole	X				Cool, moist crevices among rocks
Pine Mouse	X	X	X		Loamy or sandy soils preferred
Muskrat			X	X	Presence of herbaceous food plants
Meadow Jumping Mouse			X		Moist areas and swales preferred
Woodland Jumping Mouse	X				Cool, moist, rocky areas near water
Porcupine	X				Areas with conifers preferred
Varying Hare	X	X			Swamps and rhododendron thickets
Eastern Cottontail		X	X		Prefers mixture of brush and grassland
New England Cottontail	X	X			Presence of some herbaceous vegetation
White-tailed Deer	X	X			Extensive wooded areas; good browse

summer, and fall months. Between one and two months were generally devoted to field work in each of the various outlying study areas.

Representative series of mammals from each of the study areas were prepared as museum study skins. Additional data were recorded from a much larger number of specimens which were either subsequently discarded or catalogued only as skull specimens. Ectoparasites were preserved from some of the animals, but these await study by various experts. Ecological data were secured at every trap line, and daily notes on mammal observations were kept by each member of the field party. All of this material has been deposited in the Section of Mammals at the Carnegie Museum, Pittsburgh, Pennsylvania.

LOCALITIES TRAPPED

(Trap line numbers given in parentheses)

Trapline No.	*Date Trapped*
BRADFORD COUNTY	
2½ mi. NNW. of Wyalusing	June 5-July 15, 1950 (56-58-59-62-63-64-65-66-67-70-71)
½ mi. SW. of Wyalusing	June 12-16, 1950 (57)
2½ mi. N. of Wyalusing	June 19-23, 1950 (60-61)
1½ mi. NNW. of Wyalusing	June 27-30, July 6-10, 1950 (68-72-73)
6 mi. SSE. of Wyalusing	July 10-14, 1950 (74)
CARBON COUNTY	
1¼ mi. SE. of Lake Harmony	April 24-28, 1950 (44-45)
4½ mi. E. of Palmerton	May 1-6, 1950 (46)
8 mi. NE. of Palmerton	May 3-6, 1950 (47)
1 mi. W. of Lake Harmony	Nov. 10-16, 1950 (112)
COLUMBIA COUNTY	
3¾ mi. E. of Benton	Oct. 24-28, 1949 (27)
LUZERNE COUNTY	
6 mi. WNW. of Sweet Valley	Sept. 19-Oct. 28, 1949 (23)
7½ mi. WNW. of Sweet Valley	Sept. 26-Oct. 1, 1949 (19)
8 mi. WNW. of Sweet Valley	Sept. 19-24, 1949 (17)
8½ mi. WNW. of Sweet Valley	Sept. 26-30, 1949 (18)
7 mi. WNW. of Sweet Valley	Oct. 24-28, 1949 (28)
7½ mi. NW. of Sweet Valley	Oct. 3-8, 1949 (20)
9 mi. NW. of Sweet Valley	Oct. 3-8, 1949 (21)
MONROE COUNTY	
Pocono Lake	Nov. 1, 1949-April 28. 1950, July 17-21, Sept. 7-10, 1950 (43-90)
3 mi. NW. of Pocono Lake	Nov. 7-11, 1949 (29)
3 mi. W. of Pocono Lake	Nov. 14-18, 1949, Jan. 16-21, 1950 (30-34)
2 mi. NW. of Pocono Lake	Nov. 18-23, 1949, July 17-23, 1950, April 2-6, 1951 (31-75-76-117)
3 mi. WNW. of Pocono Lake	Jan. 3-7, 23-28, 1950 (32-36-37)
1 mi. WNW. of Pocono Lake	Jan. 16-21, 1950 (35)
2½ mi. W. of Pocono Lake	Jan. 30-Feb. 17, 1950 (40)

Trapline No.	*Date Trapped*
1½ mi. NE. of Pocono Pines	April 7-15, 1950 (39)
2¼ mi. NNW. of Pocono Pines	April 17-22, 1950 (42)
2½ mi. NNE. of Pocono Pines	July 18-21, 1950 (77)
1 mi. E. of Pocono Pines	March 27-31, 1951 (116)
1¼ mi. SW. of Pocono Summit	April 7-15, 1950 (38)
2 mi. SW. of Tobyhanna	April 17-22, 1950 (41)
5 mi. NE. of Tobyhanna	Nov. 1-4, 1950 (109)
1 mi. N. of Tobyhanna	Nov. 2-4, 1950 (110)
1 mi. ENE. of Kresgeville	May 8-13, 1950 (48-49)
2½ mi. NE. of Kresgeville	May 15-19, 22-26, 1950 (50-51-52-53-54-55)
Buck Hill Falls	Sept. 12-17, 1949 (14-15)
Blakeslee	Jan. 22-Feb. 17, 1951 (113)
2¼ mi. NE. of Blakeslee	Nov. 6-10, 1950 (111)
1 mi. SW. of Blakeslee	Feb. 19-24, April 1-5, 1951 (114)
¼ mi. S. of Blakeslee	Feb. 27-March 1, 1951 (115)
7 mi. NE. of Shawnee-on-Delaware	April 16-20, 1951 (120)
1½ mi. SSE. of Tannersville	April 23-27, 1951 (122)
1 mi. S. of Tannersville	April 30-May3, 1951 (124)
MONTOUR COUNTY	
2 mi. WNW. of Danville	April 30-May 3, 1951 (131)
2 mi. N. of Danville	May 2-4, 1951 (133)
NORTHUMBERLAND COUNTY	
1½ mi. N. of Herndon	April 11-14. 1951 (119)
2½ mi. N. of Herndon	April 12-14. 1951 (121)
2½ mi. SW. of Riverside	April 16-20, 1951 (123-125)
1 mi. S. of Montandon	April 24-27, 1951 (127)
Shamokin Island	April 27-May 10, 1951 (129)
PIKE COUNTY	
5 mi. SE. of Greentown	Aug. 2-Sept. 17, 1949 (1-2-6-7-8-12-13)
6 mi. E. of Greentown	Aug. 8-13, 1949 (3-4-5)
5 mi. E. of Greentown	Aug. 22-27, 1949 (9)
2 mi. S. of Tafton	Aug. 22-27, 1949 (10)
Bruce Lake	Aug. 29-Sept. 3, 1949 (11)
2 mi. NE. of Bushkill	April 9-13, 1951 (118)
SULLIVAN COUNTY	
1 mi. E. of Ganoga Lake	Sept. 19-20, 1949 (22)
3 mi. SSW. of Ganoga Lake	Oct. 10-14, 1949 (24-25)
1 mi. SSE. of Ganoga Lake	Oct. 17-22, 1949 (26)
SUSQUEHANNA COUNTY	
9 mi. NNW. of Montrose	July 24-Aug. 31, 1950 (78-79-84-85-87-88)
10 mi. NNW. of Montrose	Aug. 1-7, 1950 (80)
9 mi. NW. of Montrose	Aug. 7-12, 1950 (81)
5¼ mi. N. of Montrose	Aug. 14-18, 1950 (82)
7½ mi. NNW. of Montrose	Aug. 14-16, 1950 (83)
8 mi. NNE. of Montrose	Aug. 22-25, 1950 (86)
10 mi. NNW. of Montrose	Aug. 28-31. 1950 (89)

Trapline No.	*Date Trapped*
WAYNE COUNTY	
Lake Como	Sept. 11-Oct. 20, 1950 (93-96-97-98-100-101-104-106-107)
1½ mi. S. of Lake Como	Sept. 18-21, 1950 (94-95)
1½ mi. ENE. of Lake Como	Oct. 11-13, 1950 (105)
2 mi. NE. of Orson	Sept. 12-15, 1950 (92)
Island Lake	Sept. 25-27, 1950 (99)
5½ mi. NE. of Starucca	Oct. 2-6, 1950 (102)
6½ mi. NE. of Starucca	Oct. 3-6, 1950 (103)
3½ mi. NW. of Equinunk	Oct. 16-19, 1950 (108)
WYOMING	
11 mi. WSW. of Noxen	Sept. 19-24, 1949 (16)

CHECK LIST OF THE MAMMALS OF NORTHEASTERN PENNSYLVANIA

Didelphis virginiana virginiana Kerr—Virginia Opossum
Parascalops breweri (Bachman)—Hairy-tailed Mole
Condylura cristata (Linnaeus)—Star-nosed Mole
Sorex cinereus cinereus Kerr—Masked Shrew
Sorex dispar Batchelder—Big-tailed Shrew
Sorex fumeus fumeus Miller—Smoky Shrew
Sorex palustris albibarbis (Cope)—White-chinned Water Shrew
Cryptotis parva parva (Say)—Little Short-tailed Shrew
Blarina brevicauda brevicauda (Say)—Short-tailed Shrew
Myotis lucifugus lucifugus (LeConte)—Little Brown Bat
Pipistrellus subflavus obscurus Miller—New York Pigmy Bat
Eptesicus fuscus fuscus (Beauvois)—Big Brown Bat
Lasiurus borealis borealis (Muller)—Northern Red Bat*
Lasiurus cinereus (Beauvois)—Hoary Bat*
Euarctos americanus americanus (Pallas)—Black Bear
Procyon lotor lotor (Linnaeus)—Eastern Raccoon
Mustela erminea cicognanii Bonaparte—Short-tailed Weasel
Mustela rixosa allegheniensis (Rhoads)—Alleghenian Least Weasel*
Mustela frenata noveboracensis (Emmons)—Long-tailed Weasel
Mustela vison vison Schreber—Northeastern Mink*
Mustela vison mink (Peale & Beauvois)—Southeastern Mink
Lutra canadensis canadensis (Schreber)—Northeastern Otter
Martes americana americana (Turton)—American Marten†
Martes pennanti pennanti (Erxleben)—Fisher†
Mephitis mephitis nigra (Peale & Beauvois)—Eastern Skunk
Vulpes fulva fulva (Desmarest)—Eastern Red Fox
Urocyon cinereoargenteus cinereoargenteus (Schreber)—Eastern Gray Fox
Canis lupus lycaon (Schreber)—Timber Wolf†
Felis concolor cougar (Kerr)—Cougar†
Lynx canadensis canadensis Kerr—Canada Lynx†
Lynx rufus rufus (Schreber)—Eastern Bobcat
Marmota monax monax (Linnaeus)—Southeastern Woodchuck

Marmota monax rufescens Howell—Northeastern Woodchuck
Tamias striatus lysteri (Richardson)—Northeastern Chipmunk
Tamias striatus fisheri Howell—Fisher's Chipmunk*
Tamiasciurus hudsonicus loquax Bangs—Southern Red Squirrel
Sciurus carolinensis leucotis (Gapper)—Northern Gray Squirrel
Glaucomys volans volans (Linnaeus)—Eastern Flying Squirrel
Glaucomys sabrinus macrotis (Mearns)—Mearns' Flying Squirrel
Castor canadensis canadensis Kuhl—Canada Beaver
Peromyscus maniculatus gracilis (LeConte)—LeConte's Deer Mouse
Peromyscus maniculatus bairdii (Hoy & Kennicott)—Prairie Deer Mouse
Peromyscus leucopus noveboracensis (Fischer)—Fischer's Deer Mouse
Neotoma magister Baird—Allegheny Wood Rat*
Synaptomys cooperi cooperi Baird—Cooper's Lemming Mouse
Clethrionomys gapperi gapperi (Vigors)—Gapper's Red-backed Mouse
Microtus pennsylvanicus pennsylvanicus (Ord)—Pennsylvania Meadow Mouse
Microtus chrotorrhinus chrotorrhinus (Miller)—Rock Vole
Pitymys pinetorum scalopsoides (Audubon & Bachman)—Northern Pine Mouse
Ondatra zibethica zibethica (Linnaeus)—Common Muskrat
Mus musculus musculus (Linnaeus)—House Mouse
Rattus norvegicus (Erxleben)—Norway Rat
Rattus rattus rattus (Linnaeus)—Black Rat*
Zapus hudsonius hudsonius (Zimmerman)—Meadow Jumping Mouse
Napaeozapus insignis insignis (Miller)—Woodland Jumping Mouse
Erethizon dorsatum dorsatum (Linnaeus)—Canada Porcupine
Lepus americanus virginianus (Harlan)—Virginia Varying Hare
Sylvilagus floridanus mallurus (Thomas)—Eastern Cottontail
Sylvilagus transitionalis (Bangs)—New England Cottontail
Alces americanus americanus (Clinton)—Moose†
Cervus canadensis canadensis (Erxleben)—Eastern Elk†
Odocoileus virginianus borealis (Miller)—Northern White-tailed Deer
Bison bison bison (Linnaeus)—American Bison†

† Extinct species.
* Not taken during the present study.

DISCUSSION BY SPECIES

GAME AND FURBEARERS

NORTHERN WHITE-TAILED DEER

(Odocoileus virginianus borealis)

DISTRIBUTION: Occurs throughout the region.

HABITAT: Forested and semi-wooded areas.

NOTES: At the turn of the century, Rhoads (1903) stated that the white-tailed deer was most numerous in Pike County, but still present in Carbon and Monroe counties and in the North Mountain region, but very scarce in Wayne County and almost exterminated in Lackawanna. His remarks, of course, refer to the native white-tailed deer, for deer were not introduced for restocking purposes until several years after that date. Gordon (1942) stated that the first refuges were established in 1905, the earliest ones being established on State Forest lands. Each of these refuges was stocked with deer, about 50 animals being released in each area. The ratio of the sexes was about one buck to every three does. This was followed in 1907 by the enactment of the so-called "buck law" making it illegal to kill anterless deer.

At this time the cut-over, burned-over forest lands of the State were just beginning to recuperate under protective measures, and there was an unlimited amount of brush-stage forest which constituted the most optimum deer habitat that ever existed in the State. With an abundance of food and cover and with adequate protection, the deer increased so rapidly that in less than two decades local overpopulations began to cause concern. It soon became apparent that measures to control the size of the herd were necessary, and in 1928 the first State-wide antlerless deer season was declared.

Coincident with the almost phenomenal increase in the deer herd, normal ecological changes were occurring in the forests which resulted in a gradual decrease in the carrying capacity. As the trees grew out of the brush stage into the sapling and pole stages, the shade resulting from the closing in of their crowns eliminated more and more of the smaller trees and shrubs in the understory; consequently there was less and less browse available for the ever-increasing herd. As a result many forest areas were soon literally eaten out by the deer, and well defined "deer lines" began to appear in many sections. The available browse was eaten as high as the largest deer could reach. Attempts made to reforest idle and denuded acres very frequently failed, for the hungry deer

browsed even coniferous seedlings so excessively that the young trees either died or made very poor growth.

Gerstell (1938) found that most of the primary deer range in northeastern Pennsylvania was in but a fair to poor condition more than a decade ago. It has certainly not improved appreciably during the intervening years. Some of the most seriously overbrowsed deer range in the entire northeast still occurs in the uplands of Pike County. Over the entire Pocono Plateau and on the North Mountain highlands the range is only in a fair condition, and in places it is quite poor. Although a substantial decrease in numbers has occurred in some localities of the Pocono Plateau during the past ten or fifteen years, there are still excessively high numbers present in certain areas. Had the winters of the past few years been more severe and deep snows been prolonged into the early spring, there is little doubt that serious starvation losses would have occurred in many parts of the region.

According to Rhoads, the native Pennsylvania bucks averaged about 125 pounds, and the does averaged about 80 pounds when dressed. At the home of Mr. William R. Ricketts, at Ganoga Lake, Sullivan County, we saw the mounted heads of three bucks which had been killed on North Mountain prior to the turn of the century. All of them had nicely balanced, large antlers, although none of them had an unusually large number of points. They compared very favorably with the antlers of bucks taken today in those sections of the State where food conditions are most excellent.

During the open season of 1950, we obtained the weights of several deer on the Pocono Plateau in Monroe County. The average weight of 20 adult bucks was a little over 100 pounds hog dressed; and the average of 17 adult does was about 80 pounds. The largest buck seen was one which weighed 185 pounds. Its antlers had a 16-inch spread and 6 points. The average weight of 10 fawns of both sexes was 58 pounds, ranging from 42 to 78 pounds.

Many hunters complain about the preponderance of runty deer and bucks with poor antler development. This condition quite obviously reflects the poor condition of the range, excessive population, and insufficient food. Yet many deer hunters seem to be utterly oblivious to this fact, and they constantly seek for other explanations—a favorite one being that the introduction of deer from other states is necessary for the improvement of the native stock.

BREEDING: Gerstell (1936) presented data showing that the sex ratio of the fawns in the seriously overbrowsed portions of the State ran disproportionately high in favor of females. His data was based on the deer kill reports made out by hunters during the 1935 season. In Pike County the sex ratio in fawns was determined to be 1 male to 2.3 females. During the late winter and spring of 1950-1951, we obtained breeding data from 29 female deer which had been accidentally killed, mostly on highways. The bulk of our data came from Monroe and Pike counties. A total of 45 embryos were found in these

29 deer, 15 of which were males and 30 of which were females; giving a sex ratio of 1 male to 2 females in these unborn deer. While our sample is admittedly small, this prebirth sex ratio may be significant in view of Gerstell's findings. The greatest disparity in the sex ratio occurred in the single embryos—1 male to 13 females. Among the sets of twin embryos the sex ratio was more nearly equal—14 males to 18 females. It has been suggested that in areas where food conditions are poor there is a tendency for one of the embryos to be resorbed, and that it is most often the male embryo when the twins are of both sexes. The data at hand certainly tends to support this theory, but further research should be conducted along this line.

During the late winter and spring of 1951, the ages of all deer examined were determined by tooth development and wear, according to the criteria developed by Severinghaus (1949). Out of a total of 13 fawn does examined only two were found to be bred, and each of these was carrying a single female embryo. The oldest doe examined was a 7-year old animal, and it also was carrying a single female embryo. The eight cases of twin embryos in 1951 were found in does between 2 and 5 years old. Out of the total of 29 pregnant does examined during both years there were 16 instances of twin embryos. In six of these there was an embryo of each sex; in six both of the embryos were females; and in four both of the embryos were males.

FOOD HABITS: The white-tailed deer is both a grazing and browsing animal. They are often seen in open fields feeding on grasses and other herbaceous plants whenever the ground is free of snow. In this region there are relatively few woody plants which are not browsed to some extent, but the gray birch *(Betula populifolia)*, meadowsweets *(Spiraea* sp.), and the sheep laurel *(Kalmia angustifolia)* seem to be quite generally shunned. Among the most highly preferred browse species are the red maple *(Acer rubrum)*, striped maple *(Acer pennsylvanicum)*, mountain maple *(Acer spicatum)*, mountain ash *(Sorbus americana)*, and the hobblebush *(Viburnum alnifolium)*. In the more seriously overbrowsed areas the woodlands are virtually devoid of seedlings, coppice, or understory shrubs. Excessive browsing of rhododendron *(Rhododendron maximum)*, mountain laurel *(Kalmia latifolia)*, hemlock *(Tsuga canadensis)*, and the coppice of beech *(Fagus grandifolia)* is invariably indicative of an excessively high deer population and poor food conditions. Many wild fruits are also eaten by deer when they are available, and apples are always relished. Deer nightly pay visits to orchards and isolated apple trees to feed on the fallen fruits.

The legal deer kill in the various counties covered by this report, for the years 1934 to 1950 inclusive, is given in the table below.

LEGAL DEER KILL BY COUNTIES

(Upper figure is legal antlered deer; lower figure is antlerless deer)

County	*1934*	*1935*	*1936*	*1937*	*1938*	*1939*	*1940*	*1941*	*1942*	*1943*	*1944*	*1945*	*1946*	*1947*	*1948*	*1949*	*1950*
Bradford	290	310	144	379	—	871	640	289	533	470	611	525	662	556	760	1065	532
(1,145 sq. mi.)	—	849	—	—	2824	—	2705	—	—	—	—	—	—	1230	—	1845	1501
Carbon	79	131	240	257	—	454	501	175	285	208	292	282	291	285	295	404	221
(406 sq. mi.)	—	—	—	—	3729	—	1737	—	—	—	—	—	206	329	—	628	505
Columbia	116	95	92	251	—	280	227	70	144	119	221	177	210	272	274	389	191
(479 sq. mi.)	—	—	—	—	866	—	720	—	—	—	—	—	—	417	—	669	549
Lackawanna	115	88	110	130	—	356	247	99	140	135	201	174	176	206	187	310	158
(451 sq. mi.)	—	—	—	—	1327	—	1035	—	—	—	—	—	—	409	—	513	453
Luzerne	130	420	395	232	—	1071	862	300	482	380	656	597	528	690	770	1083	472
(892 sq. mi.)	—	—	—	—	4500	—	3595	—	—	—	—	—	166	1406	—	2414	1476
Monroe	250	307	325	425	—	1473	1163	458	763	715	919	713	634	671	648	970	550
(623 sq. mi.)	—	—	—	—	4386	—	4193	—	—	—	—	—	—	1275	—	1890	1304
Montour	8	11	12	24	—	22	23	3	6	11	22	27	24	56	45	59	23
(130 sq. mi.)	—	—	—	—	78	—	56	—	—	—	—	—	—	49	—	121	123
Northumberland	27	38	64	91	—	70	92	18	45	49	72	83	98	126	152	198	106
(454 sq. mi.)	—	—	—	—	452	—	285	—	—	—	—	—	—	181	—	339	370
Pike	637	672	491	670	—	2348	1537	824	1313	1204	1347	1153	1028	914	959	1091	931
(544 sq. mi.)	—	4500	—	—	5030	—	5262	—	—	—	—	—	—	2215	—	2270	—
Susquehanna	80	121	145	150	—	210	237	94	235	175	373	304	272	382	421	629	392
(824 sq. mi.)	—	—	—	—	674	—	863	—	—	—	—	—	877	413	—	783	759
Wayne	120	200	218	196	—	689	536	248	437	417	618	453	476	609	608	842	566
(739 sq. mi.)	—	—	—	—	1778	—	1960	—	—	—	—	—	1030	703	—	998	1272
Wyoming	96	160	175	220	—	454	354	211	235	201	295	257	289	346	313	463	240
(397 sq. mi.)	—	—	—	—	1419	—	1230	—	—	—	—	—	521	617	—	835	601

BLACK BEAR

(Euarctos americanus americanus)

DISTRIBUTION: Common to fairly common in the more extensively forested parts of the Pocono Plateau, Pike County, and the North Mountain region. The heaviest population occurs in Pike County. It is fairly common to common in Bradford, Carbon, Columbia, Lackawanna, Luzerne, Monroe, Wayne, and Wyoming counties; and rare or absent in Montour, Northumberland, and Susquehanna counties.

HABITAT: Extensively forested areas regardless of their composition.

NOTES: The black bear has most certainly increased in numbers during the last half century. Rhoads (1903) mentioned its presence in Monroe, Pike, Luzerne, and Lackawanna counties at that time; but he stated that it had not been present in Columbia County for at least 50 years, and in Wayne County his correspondents were somewhat in disagreement as to it status—their estimates ranging all the way from "almost extinct" to "increasing in numbers."

Had it not been for protective legislation the black bear would very probably be extinct today; but during the past fifteen years more than 850 of them have been legally taken in the counties of northeastern Pennsylvania—over 340 of them in Pike County alone. The annual take of black bears in the various counties covered by this report is given in the following table:

Gordon (1924) cited what is perhaps the largest Pennsylvania black bear on record. This individual weighed 633 pounds when it was killed, 538 pounds after it was hog dressed, measured 9 feet in length, and was 19 inches between the tips of its ears. It was killed near Milford, Pike County, on December 4, 1923. The average size of the bears taken is, of course, much smaller. Luttringer (1931) gave the average weight of adults as between 250 and 300 pounds, which is about the average of those taken in this region.

The young are born during the winter while the mother is in hibernation. During the second week in March, 1950, a hibernating female with three cubs was discovered on the game lands a few miles south of Tobyhanna, Monroe County. Game Protector John Doebling, who observed them shortly after they were discovered, states that the cubs were very small but well furred and that their eyes were open.

During the summer months bears consume large quantities of wild fruits, and they are particularly fond of those of the shadbushes and blueberries, both of which are abundant in this region. During the summer of 1949, a large individual came bounding out of the brush in the vicinity of Tobyhanna and ran into the side of a passing automobile; it immediately disgorged its dinner, spewing blueberries all over the side of the car. These animals never fail to excite the curiosity of tourists and summer visitors whenever they are seen.

LEGAL KILL OF BLACK BEAR

County	*1935*	*1936*	*1937*	*1938*	*1939*	*1940*	*1941*	*1942*	*1943*	*1944*	*1945*	*1946*	*1947*	*1948*	*1949*	*1950*
Bradford	2	1	0	*	1	8	0	1	3	3	4	5	17	11	2	7
Carbon	1	1	1	*	5	1	2	0	0	1	0	7	2	1	1	0
Columbia	3	8	0	*	2	4	1	2	1	0	2	0	1	1	0	1
Lackawanna	3	0	0	*	1	4	2	0	0	2	0	1	3	2	9	5
Luzerne	3	6	14	*	6	9	6	2	1	5	1	3	4	0	4	3
Monroe	5	2	5	*	8	3	3	4	6	4	4	8	7	13	8	14
Montour	0	0	0	*	0	0	0	0	0	0	0	0	0	0	0	0
Northumberland	0	0	0	*	0	0	0	0	0	0	0	0	0	0	0	0
Pike	13	13	15	*	11	14	37	8	8	34	29	32	36	40	21	30
Susquehanna	0	0	0	*	0	0	0	0	0	0	0	0	0	0	0	0
Wayne	0	0	21	*	3	3	0	0	2	10	1	2	6	3	9	11
Wyoming	9	19	29	*	8	19	6	4	2	6	5	4	11	1	8	6

VARYING HARE

(Lepus americanus virginianus)

DISTRIBUTION: Occurs on the Pocono Plateau in Monroe, Carbon, and Luzerne counties; in the North Mountain region; and northward through Wayne and Pike counties.

HABITAT: Usually swamps and extensive boggy areas, or thickets of rhododendrons along streams in the Canadian Zone.

NOTES: A half century ago, Rhoads (1903) stated that the varying hare was not uncommon in the higher mountain swamps of Monroe, Wayne, and Pike counties, and that it was still present on North Mountain. We learned from local game protectors and from old residents of the North Mountain region that they were still present along the higher mountains, but no longer in the immense numbers of former years. In the vast swamps and bogs of the Pocono region and northward through Pike County, the species seems to have fared better and it is currently common. In this region we have been told that there has been a marked increase in their numbers in recent years. Game Protector Paul L. Failor, of Mount Pocono, Monroe County, states that he has observed a significant increase in the "snowshoe" population, and he believes that it might be attributed to the recent decline in the number of deer. We have observed signs of their presence in most of the larger swamps and bogs on the Pocono Plateau, and have seen at least five which were killed on the highways by cars.

The seasonal pelage change from the brown summer coat to the white winter one is sometimes completed by the latter part of November, and usually at least before mid-December; but we received a male from Mr. Harrison Slutter, that he had killed near Promised Land Lake, Pike County, on December 22, 1949, which was still partially brown. One observed dead on the road near Pocono Summit on May 3, 1951, was completely in the brown summer pelage. The change from the winter to summer pelage seems to take place rather gradually between mid-March and late April.

FOOD HABITS: The varying hare consumes a variety of woody vegetation, but the bark and smaller shoots of the aspens seem to be a favorite food. Hemlock and balsam fir are also eaten quite frequently during the winter season. From spring to late fall it consumes a variety of herbaceous plants. One killed on the road near Pocono Pines, on June 16, 1951, had a leaf of plantain *(Plantago)* in its mouth.

BREEDING: A female found dead on the road between Pocono Pines and Pocono Summit, Monroe County, on April 26, 1950, contained 3 embryos averaging 140 mm. in length. They were well-furred. Another killed near Pocono Pines on June 16, 1951, also contained 3 embryos; but they averaged only 20 mm. in length. The latter female had copious fatty tissue in the mammary glands, and had apparently lactated recently. Thus the small embryos evidently represented a second brood for the season.

SPECIMENS TAKEN: 5—Monroe 4, Pike 1.

EASTERN COTTONTAIL

(Sylvilagus floridanus mallurus)

DISTRIBUTION: Occurs throughout the region.

HABITAT: Optimum habitat consists of an interspersion of open areas with an abundance of herbaceous vegetation and of briar patches and brush. Wooded areas, particularly of hardwoods with a dense ground cover including herbaceous plants, are often occupied. Recent clearings afford excellent habitat. It is often common in urban communities where lawns, gardens, and shrubbery are fairly extensive.

NOTES: The cottontail is widely distributed and locally common to abundant. It is the most popular and most intensively hunted small game mammal; and it has a host of natural enemies including foxes, skunks, weasels, hawks, owls, and marauding house cats. Nevertheless, wherever food and cover conditions are ideal, sufficient breeding stock generally survives all hazards to maintain a maximum population.

During the fall of 1949, the nursery and its vicinity on the Wagner property near Pocono Lake was hunted for rabbits about as intensively as most comparable areas. During the winter of 1949-1950 we set box traps in the area and removed approximately 20 individuals; yet the population during the summer of 1950 was not obviously below what it had been the previous year. No predator control of any kind was conducted.

A surprisingly large number of cottontails, all apparently of this species, are killed on the highway between Pocono Pines and Pocono Summit in Monroe County. The road here traverses wild country, most of it occupied by pitch pines or forest of the scrub oak and gray birch-aspen types well interspersed with boggy areas. The understory of woody and herbaceous plants is very dense, and fires apparently have not occurred for several years.

FOOD HABITS: From spring until late fall and even in winter when the ground is not deeply covered with snow and ice, the cottontail feeds primarily on herbaceous vegetation. In winter when the snows are deep, it subsists chiefly on the bark of woody plants. Clovers of all kinds seem to be a favorite food. On the lawn about our headquarters cabin near Wyalusing, they were observed eating the stalks and heads of timothy. Gardeners are, of course, well aware of the cottontail's appetite for such cultivated plants as beans, soybeans, and peas. Winter utilization of the bark of the apple, blackberry, silky dogwood, sumacs, and witch hazel and the younger twigs of hemlock was observed.

BREEDING: Information was obtained from only one female which was collected near Wyalusing, Bradford County, on July 5, 1950. There were 4 embryos averaging 75 mm. in length.

SPECIMENS TAKEN: 16—Bradford 2, Luzerne 2, Monroe 6, Pike 5, Wayne 1.

NEW ENGLAND COTTONTAIL

(Sylvilagus transitionalis)

DISTRIBUTION: Probably throughout the region at higher elevations.

HABITAT: Woods and brushy areas.

NOTES: The New England Cottontail is primarily a woodland species, and it should be expected to occur in the highlands throughout northeastern Pennsylvania. Greene (1930) listed it among the mammals of the North Mountain region. Mr. Wilmer C. Richter, Leader of Pittmann-Robertson Project 26-R, has sent a total of 17 rabbit skulls from State Game Lands 187, Luzerne County, to the Carnegie Museum, seven of which have been identified as *Sylvilagus transitionalis.* Dr. Doutt has identified one of our specimens from southeastern Pike County as being of this species.

Most of the *transitionalis* taken on State Game Lands 187 were in scrub oak areas.

SOUTHEASTERN WOODCHUCK

(Marmota monax monax)

DISTRIBUTION: Occurs through the region.

HABITAT: Lives in both wooded and open areas if herbaceous vegetation is available. The optimum habitat is the boundary between forest edge or brush and open fields where herbaceous food plants are found in some abundance.

NOTES: The woodchuck is common in most sections of northeastern Pennsylvania. It occurs in small numbers in the wooded areas, attaining its greatest abundance in cut-over areas and in the farming sections. Melanistic individuals were observed in the vicinity of Wyalusing, Bradford County, and near Montrose, Susquehanna County.

Farmers, gardeners, and nurseymen in general do not look too kindly on the woodchuck and its activities, but hunters armed with rifles equipped with telescope sights derive much midsummer sport 'chuck shooting. A correspondent of Dr. B. H. Warren, from Plume, Lackawanna County, quoted in Warren's *Diseases and Enemies of Poultry,* summed up the agriculturist's viewpoint when he stated that the woodchuck "eats to give him strength to dig holes, and then he digs holes to give him an appetite for more clover." In the farming regions the woodchuck is indeed often a pest, but in the wilder and wooded sections he is certainly a desirable citizen. Their holes are utilized by other forms of wildlife.

FOOD HABITS: Woodchucks feed on a variety of herbaceous vegetation, but clovers and plantains are preferred. When located near a garden they soon develop a taste for cultivated vegetables, and a single animal can wipe out a good-sized bean patch in a short time. They often cause considerable damage in corn fields, particularly when the

ears are in the milk stage. In the forested sections they are often seen feeding on the succulent vegetation which grows along the roads, particularly on the berms of highways. While engaged in feeding they are always on the alert, and, at the slightest premonition of danger, will dash headlong into their burrow or dense cover.

BREEDING: Breeding takes place very early in the spring, or even late winter, shortly after the animals emerge from their winter hibernation. The young are born in late April or early May. During the first week in June we have observed many young ones foraging for themselves, and probably most of the young are weaned before the middle of that month.

SPECIMENS TAKEN: 9—Bradford 1, Sullivan 2, Susquehanna 1, Monroe 4, Wayne 1.

According to Dr. Doutt, our specimens from Ganoga Lake, Sullivan County, and from the northern portions of Susquehanna and Wayne counties may be referable to the race *rufescens*, the Northeastern Woodchuck, although they show some intergradation with the race *monax*. Those taken on the Pocono Plateau and in the lowlands are referable to *Marmota monax monax*.

NORTHERN GRAY SQUIRREL

(Sciurus carolinensis leucotis)

DISTRIBUTION: Occurs throughout the region.

HABITAT: Mature forests of hardwoods or of mixed hardwoods and conifers. The optimum habitat must have a good percentage of such mast-producing trees as oaks, hickories, walnuts, or beeches.

NOTES: The gray squirrel is common to abundant in the wooded lowlands of northeastern Pennsylvania, but somewhat less common in the highlands. It seemed to be relatively scarce during the summer of 1950 in the highlands of northern Susquehanna and Wayne counties, but local residents state that they are never common there. On the Pocono Plateau it occurs quite commonly wherever there are stands of large oaks and beeches, but the tracts of such trees are now rather limited in area. The species is more common in the Susquehanna and Delaware valleys.

During the fall of 1949, we found gray squirrels to be quite abundant in the vicinity of Rickett's Glen State Park in the North Mountain region. On October 13, Rutledge observed that the animals seemed to be everywhere on the slope of the mountain. He saw four or five in one hickory tree, cutting and eating nuts; and many others were on the ground and in the nearby chestnut oaks. He could not make an estimate of their numbers because so many were travelling back and forth on the hillside. As he was watching the squirrels, a red fox trotted by the hickory tree, whereupon all of the squirrels vigorously protested by barking. The abundance of squirrels was not noted when he went up the mountain about one o'clock, but they were literally everywhere when he returned about three hours later.

Mr. Clarence Bonser told us that he witnessed a mass migration of gray squirrels at the Pocono Lake Preserve, Monroe County, some eight or ten years ago. Ordinarily, claims Mr. Bonser, they are quite scarce in that vicinity; but on this occasion they seemed to be about everywhere. When they came to the lake, they attempted to swim across. This incident recalls the historic accounts of the great mass movements of the animals in pioneer days, when so great were their numbers and so devastating the damage inflicted on the settler's crops, that bounties were often paid for their destruction.

The black phase of the gray squirrel is rarely seen today in this region. Rhoads (1903) stated that this color phase was rare a half century ago. One of his correspondents, Mr. G. D. Stevens, stated that the ratio of black to gray squirrels was about 1 to 75 in Wayne County at the turn of the century; but thirty years or so previous the ratio was nearly equal. We heard several reports of black squirrels in the northern counties but actually observed none during our field work.

FOOD HABITS: The gray squirrel feeds on a variety of wild fruits and seeds, but acorns and various other nuts constitute its staple diet. Hickory nuts are often cut and eaten while still green. Nuts are cached for the winter, being buried singly in the duff on the forest floor. On August 9, 1949, at Promised Land Lake, Pike County, we observed a squirrel in a highbush blueberry, where it evidently was dining on the luscious fruits.

SPECIMENS TAKEN: 15—Luzerne 2, Monroe 3, Pike 1, Susquehanna 1, Wayne 8.

SOUTHERN RED SQUIRREL

(Tamiasciurus hudsonicus loquax)

DISTRIBUTION: Occurs throughout the region.

HABITAT: Generally in mature or all-age stands of coniferous trees, or in mixed conifers and hardwoods.

NOTES: The red squirrel is common in some localities and relatively scarce in others. While it was generally present in most stands of coniferous trees, it was sometimes scarce; and in some apparently optimum habitats it seemed to be absent. On the Pocono Plateau we observed a definite increase in the winter population in 1950-1951 over that of the previous year.

Red squirrels are vivacious, pugnacious, and rather noisy animals. Their presence in a tract of woodland is usually soon detected for they are constantly chasing one another through the tree tops, chattering and barking incessantly. Quite a few of the adults taken on the Pocono Plateau were bob-tailed, and we concluded that they must have lost the tips of their tails during intra-specific fights. Much has been written and told about the friction which exists between the red squirrel and the larger gray squirrel, and many hunters stoutly maintain that the latter will not live in the same locality as the former. We once observed

an apparently very angry red squirrel in hot pursuit of a gray, but we often found them both inhabiting the same woodland.

On another occasion we observed a much-excited red squirrel which was a bit hesitant about getting into an encounter with a large Norway rat. The former had taken its position on the trunk of a large tree with the rat at its base. Each time the squirrel dared to come close to the ground, the rat rushed at it and forced it to retreat up the trunk. Once the rat ran about four feet up the tree trunk after the squirrel, which beat a hurried retreat to higher regions.

FOOD HABITS: The red squirrel is exceedingly fond of the seeds of the various coniferous trees, and the ground beneath such trees is often littered with chewed up cones. Quite often the cones are carried to some favorite feeding spot, such as the top of a log or stump, and piles of cone fragments are left on the animal's "dinner table." Acorns, hickory and hazel nuts, and the seeds of wild cherries are likewise staple foods. In front of our field headquarters near Wyalusing there was an elm tree, many of the leaves of which were curled and knotted by aphids, and red squirrels were frequently seen eating these gall-like growths. We observed a small stand of white pines near Pocono Lake that were rather heavily barked by red squirrels during the past winter. Apparently there were no cones on the trees this past year, and the animals had been eating the bark off the branches. The snow beneath the trees was littered with bark fragments, and there was a veritable maze of red squirrel tracks.

BREEDING: No embryos were found in any of the females collected; but one taken on August 24, 1949, showed 8 placental scars and was lactating. Another taken on September 14, 1949, had 5 scars. Males taken during the latter part of February were invariably in breeding condition. The majority of those taken in eastern Bradford County, during the month of June, were nearly full-grown subadults, evidently from an early spring litter. Two litters a year are probably not uncommon.

SPECIMENS TAKEN: 26—Bradford 5, Carbon 1, Luzerne 1, Monroe 14, Pike 2, Wayne 3.

EASTERN RACCOON

(Procyon lotor lotor)

DISTRIBUTION: Occurs throughout the region and fairly common to abundant in most counties.

HABITAT: Wooded and semi-wooded areas. Optimum habitat is afforded by either unbroken or broken tracts of mature or all-age forest, providing den sites in the form of hollow trees or crevices among rocks are available. Wooded stream valleys and the wooded shores of lakes seem to be highly preferred.

NOTES: During the period of this survey the tracks or spoor of raccoons were found in a great many of the localities studied. The animals seemed to be generally common in stream valleys and about

the wooded margins of lakes and ponds. In recent years the low prices paid for their pelts has not induced the trappers to take them in such large numbers; and this may account, at least in part, for the present high population of these animals.

FOOD HABITS: Whenever possible the scats of raccoons were examined in the field. Fruits such as Juneberries, blueberries, and wild cherries generally comprised the bulk of their diet when obtainable. The remains of insects, crayfish, and fish were frequently noted, and in a few instances the fur of mammals—chiefly small rodents and rabbits—was found to be present. Many game protectors are of the opinion that the racoon is currently the most serious predator in the region.

SPECIMENS TAKEN: 2—Pike 2.

VIRGINIA OPOSSUM

(Didelphis virginiana virginiana)

DISTRIBUTION: Occurs throughout the region, but somewhat more uncommon in the extreme northern portions of Susquehanna and Wayne counties.

HABITAT: Wooded and semi-wooded areas.

NOTES: The opossum apparently was not present in the region at the time of its settlement by the white man. It is not mentioned in the long list of mammals whose remains were found in Hartman's Cave, near Stroudsburg, Monroe County, although it is abundant in that region at the present time. According to Rhoads (1903) the species had invaded the lowlands prior to the turn of the century. He further states that specimens had been taken at Porter's Lake, Pike County, but it was rare on the Pocono Plateau. The opossum is a southern species which has been gradually extending its range northward in the present region, evidently within the past century.

It has increased greatly in numbers within the past 25 or 30 years. Old trappers on the Pocono Plateau state that they were utterly unacquainted with the animal until about 1920, or shortly thereafter; and in northern Wayne and Susquehanna it was virtually unknown until comparatively recent years. Today the opossum is quite abundant on the Pocono Plateau, as well as in the surrounding lowlands. We found a large individual which had been killed by a car on the summit of North Mountain, at an elevation of approximately 2,300 feet. A high percentage of the ones examined on the Pocono Plateau plainly showed signs that they had had, at some time or another, both their tails and ears frozen.

This stupid and slow-moving animal is regularly killed on the highways of the region, and the number seen dead on the roads was taken as fairly indicative of local populations. Several times we observed an opossum which had been killed beside a rabbit or some other animal. The former was apparently feeding on the carcass of a previous highway victim at the time it was killed. The low prices paid for opossum pelts in recent years has offered no inducement to the trapper, but the

animals constantly blunder into sets made expressly for other fur-bearers. Most trappers regard the opossum to be nothing more than a nuisance.

BREEDING: A female taken on March 18, 1950, at Thornhurst, Monroe County, had recently been bred. One taken at Pocono Lake on September 10, 1950, had three young in her pouch which averaged less than 2 ounces each. Juvenile individuals weighing a pound or less were observed on the Pocono Plateau late in the month of November.

SPECIMENS TAKEN: 13—Luzerne 1, Monroe 9, Pike 2, Wayne 1.

CANADA BEAVER

(Castor canadensis canadensis)

DISTRIBUTION: Occurs more or less locally throughout the region.

HABITAT: Streams in forested areas where a food supply is available.

NOTES: The beaver was exterminated in the counties of northeastern Pennsylvania about the middle of the last century. According to Rhoads (1903), old dams and beaver meadows were still in evidence along Bushkill and Dingman's Creeks at the turn of the present century. The same author stated that in 1901 some beavers appeared and built dams along McMichael's Creek, near Stroudsburg, Monroe County. They were believed to have been animals which had escaped from a park or preserve in New Jersey. At the time they created quite a sensation and received no small amount of newspaper publicity, but we do not know their ultimate fate.

In 1917, the Game Commission released a pair of beavers in Cameron County. These animals had been presented to the Commission by the State of Wisconsin. Four pairs were purchased in Canada and released in 1919, and an additional twenty-four pairs of Canadian beavers were planted in various state game refuges the following year. The reintroduction of the beaver was so successful that by 1934 it was deemed necessary to harvest the surplus animals. By that time the beaver had spread widely from the points of introduction, and beaver colonies had been established in more than two-thirds of the counties of the state.

Today one can find flourishing beaver colonies in virtually every part of northeastern Pennsylvania. They are most common on the broad summit of North Mountain and on parts of the Pocono Plateau. The dams created by beavers provide some of the best waterfowl habitat to be found in the region. Wood ducks and black ducks breed quite regularly about the beaver ponds, and migrating waterfowl visit them in no small numbers during their migrations. It seems that the most expedient method of creating waterfowl habitat in the glaciated back country of this region is merely to encourage the beaver. Although we have often heard complaints about the destruction of timber by beavers, we found exceedingly few places where any great damage had been done to even potentially valuable stands of timber. The loss, if any, was usually greatly offset by the gain.

LEGAL TAKE OF BEAVERS

County	*1941*	*1942*	*1943*	*1944*	*1945*	*1946*	*1947*	*1948*	*1949*	*1950*	*1951*
Bradford	0	53	35	81	36	77	52	96	93	60	91
Carbon	0	0	25	32	9	14	5	7	0	1	0
Columbia	0	4	8	15	10	7	6	8	4	0	1
Lackawanna	2	1	5	2	2	3	1	9	4	11	13
Luzerne	69	0	106	0	160	194	88	148	145	68	123
Monroe	53	74	36	87	36	44	40	48	59	34	49
Montour	0	3	2	0	0	1	0	0	0	0	3
Northumberland	0	1	0	0	0	0	0	0	0	0	0
Pike	73	81	76	117	42	95	82	110	96	46	101
Susquehanna	21	27	14	26	23	38	27	43	54	39	58
Wayne	41	42	46	87	34	83	112	136	221	114	247
Wyoming	0	0	14	30	13	18	34	31	29	35	53

FOOD HABITS: The preferred food of the beaver is the bark of various trees, but particularly that of the aspens. Gray birch was often utilized on North Mountain. Where the food supply is at some distance from the water only the branches of the larger trees seem to be utilized as a rule. They are dragged over trails to the water. We observed no constructions of canals to the food supply. The branches from which the bark is eaten are utilized in the construction of the dams and houses.

BREEDING: In 1950 the beaver season extended from February 15 to March 1. Game Protector Paul L. Failor, of Mount Pocono, stated that he had examined a female which contained 9 small embryos. Another was reported with 7 embryos. A male taken near Tobyhanna, Monroe County, on February 22, 1950, was in breeding condition.

SPECIMENS OBTAINED: 6—Lackawanna 1, Monroe 5.

COMMON MUSKRAT

(Ondatra zibethica zibethica)

DISTRIBUTION: Occurs in suitable habitats throughout the region.

HABITAT: Ponds, marshes, and slow-flowing streams wherever suitable herbaceous food plants are present.

NOTES: The muskrat is found quite generally throughout the counties of northeastern Pennsylvania, but the areas of optimum habitat are by no means extensive. Most of the animals occur along the rivers and larger creeks, in beaver ponds, or the shallower margins of the lakes. The numerous, fast-flowing, rocky-bedded mountain streams are usually devoid of muskrats, because suitable food plants are generally very scarce or absent.

In former years this animal was apparently abundant along the Susquehanna and Delaware rivers, as well as the larger tributary streams, but in recent years their numbers seem to have declined considerably. Overtrapping was ostensibly the cause. The season was closed in 1950-51, and the following spring the muskrat population was reported to have been much higher than it had been for some time. In some sections many were killed on highways during the early spring, and game protectors were beginning to receive complaints of damage caused by the animals.

The muskrat is the most highly prized of all our furbearers, and in recent years good pelts have consistently brought premium prices.

Melanistic individuals are not uncommon in some parts of the region, although the majority of the animals are of the normal brown color. We obtained two dark muskrats at Pocono Lake, Monroe County. Their upperparts were black or nearly so, but the underparts were brownish. Mr. Harrison Slutter tells us that he has generally taken these black muskrats in the small streams of the spruce bogs, and brown ones along the larger streams.

FOOD HABITS: Muskrats feed on a wide variety of herbaceous vegetation including grasses, sedges, rushes, plantains, and clovers. Cattails and bur-reeds are extensively utilized wherever they occur, and the tubers of the arrowheads *(Sagittaria* sp.) seem to be especially relished. Various aquatics such as the waterweed *(Anacharis)*, coontail *(Ceratophyllum)*, and pondweeds *(Potamogeton* sp.) are also eaten occasionally.

SPECIMENS TAKEN: 3—Monroe 3.

EASTERN SKUNK

(Mephitis mephitis nigra)

DISTRIBUTION: Occurs throughout the region.

HABITAT: Wooded and semi-wooded areas.

NOTES: Skunks are quite common in northeastern Pennsylvania, and many of them are killed on regional highways. There apparently has been no appreciable decline in their numbers during recent years, such as was evident in the northwestern part of the state (Richmond and Roslund, 1949).

Individuals of both sexes were taken during the winter months, but the males were evidently much more active than the females at this season of the year. Several of those taken during the month of March had evidently been in hibernation. They appeared to be rather thin; and the skin on the soles of their feet, and sometimes also that about their heads, tended to slough off in scaly flakes. The nails of the fore feet were often very long.

FOOD HABITS: During the warmer months insects figure prominently in the skunk's diet, and wild fruits of many kinds are eaten whenever they are available. Other items found in the few stomachs which were examined included the remains of meadow mice, small snakes, cottontail rabbits, and deer, the latter obviously being carrion. The eggs of various turtles are dug up and devoured with great relish, and skunks undoubtedly take their toll of the eggs of ground-nesting birds. Garbage dumps about camps and cabins are visited at night with regularity.

BREEDING: Increased activity was invariably noted about skunk dens during the latter part of February or early March, this being the animal's mating season. A female taken at Pocono Lake, March 29, 1950, had three embryos averaging 5 mm. in length.

SPECIMENS TAKEN: 13—Luzerne 1, Monroe 10, Pike 2.

SHORT-TAILED WEASEL

(Mustela erminea cicognanii)

DISTRIBUTION: Occurs at least locally throughout the region.

HABITAT: Wooded and semi-wooded areas.

NOTES: This little weasel is much less common, and less widely distributed, than the long-tailed weasel. Greene (1930) included it among the mammals of the North Mountain region; and we talked with trappers who were certainly familiar with it. It seems to be taken quite frequently on the Pocono Plateau. The species, however, is not confined to Canadian Zone areas, for specimens from Wyoming and Towanda in the Susquehanna Valley have been received in the Bounty Claims Office of the Game Commission.

Three specimens were secured near Pocono Lake, Monroe County, during February and early March of 1950, all of which were in the white winter pelage. One of these was a female which showed no indication that it had ever been bred. The males were not in breeding condition. A high percentage of these weasels assume a white winter pelage, but occasionally one will remain brown.

Most trappers refer to this little weasel as the "ermine," and a few confuse it with the Least Weasel, a species which barely enters our region.

SPECIMENS TAKEN: 3—Monroe 3.

BOUNTY RECORDS: 19—Bradford 14, Carbon 1, Luzerne 2, Susquehanna 1, Wayne 1.

LONG-TAILED WEASEL

(Mustela frenata noveboracensis)

DISTRIBUTION: Occurs throughout the region and locally common.

HABITAT: Wooded and semi-wooded areas. It is often found along brushy fencerows or about stone fences in the farming sections.

NOTES: The long-tailed, or New York weasel, is the common species throughout the region. The accompanying table shows the number of weasels presented for bounty from the various counties of northeastern Pennsylvania in the last 14 years. Inasmuch as the bulk of them were of this species, the table gives a fairly good picture of this animal's abundance in the various parts of the region. The number of weasels bountied during the period was greatest in Luzerne County with approximately 16 per square mile, and least in Pike County with slightly more than one per square mile. Ten or more animals per square mile were also presented for bounty from Northumberland and Columbia counties.

This species does not assume a white winter pelage as consistently as does the short-tailed weasel. During the winter of 1949-1950, Mr. Harrison Slutter trapped six of them in the vicinity of Pocono Lake, Monroe County, five of which were in brown pelage.

SPECIMENS TAKEN: 1—Carbon 1.

WEASELS PRESENTED FOR BOUNTY

County	*Area Sq. Mi.*	*1937-38*	*1938-39*	*1939-40*	*1940-41*	*1941-42*	*1942-43*	*1943-44*	*1944-45*	*1945-46*	*1946-47*	*1947-48*	*1948-49*	*1949-50*	*1950-51*
Bradford	1,145	634	1,113	1,502	247	261	258	396	76	270	389	637	1,433	373	162
Carbon	406	179	304	352	177	148	172	132	22	134	152	163	222	291	191
Columbia	479	514	636	678	192	280	413	349	134	463	701	617	534	539	245
Lackawanna	451	142	250	373	160	201	201	144	48	131	185	153	296	148	76
Luzerne	892	755	1,040	1,554	840	870	1,249	673	228	711	1,291	1,246	2,005	1,703	1,207
Monroe	623	184	243	432	195	174	245	127	46	107	175	106	189	118	67
Montour	130	132	103	141	35	45	64	37	32	72	146	103	99	61	40
Northumberland ...	454	503	393	574	204	226	324	250	110	276	447	476	421	318	202
Pike	544	46	59	150	77	35	116	52	8	26	49	27	55	28	17
Susquehanna	824	266	512	940	183	150	73	136	28	133	162	197	365	84	48
Wayne	739	179	290	490	166	109	87	154	24	114	125	130	242	76	81
Wyoming	397	184	254	459	68	66	111	130	24	96	134	188	308	150	107
TOTAL		3,534	5,197	7,645	2,544	2,565	3,313	2,580	780	2,533	3,956	4,043	6,169	3,889	2,443

ALLEGHENIAN LEAST WEASEL

(Mustela rixosa allegheniensis)

Mr. Harold L. Plasterer, Supervisor of the Bounty Claims Section, Pennsylvania Game Commission, states that a weasel of this species was received from Wyalusing Township, Bradford County. The animal was killed on March 2, 1950. This is, as far as we know, the only record from the present region. The species is evidently quite rare here.

NORTHEASTERN OTTER

(Lutra canadensis canadensis)

DISTRIBUTION: Occurs, or has recently occurred, throughout the lake country of Pike, Wayne, Monroe, and Luzerne counties. Occasionally present along the Susquehanna and Delaware rivers and their tributaries, but now very rare.

HABITAT: Lakes and streams, chiefly in the wilder and forested sections.

NOTES: The otter, in spite of persecution, has continued to persist in the glaciated uplands of northeastern Pennsylvania. It is no longer common, and it has almost entirely disappeared from most of its former range. It is most common on the Pocono Plateau and in southern Pike County; but virtually nonexistent or very rare today in the lake country of northern Wayne and Susquehanna counties, and in the North Mountain region.

Present laws do not afford the otter sufficient protection, and a great deal of prejudice against the animal is evident in the ranks of fishermen. Some even go so far as to blame the *past* presence of otters for the poor fishing found in so many of the regional lakes. It must, of course, be admitted that the otter is a fish-eating mammal; but the damage done to game fish in the lakes and streams is greatly over exaggerated. About fish hatcheries and rearing pools, where the fish are confined, the story is naturally somewhat different. Both of the specimens given to the survey were trapped by game protectors from trout rearing ponds, following complaints that the animals were making heavy inroads on the fish. Trembley (1948), who has made extensive studies of lakes in the Poconos, has shown that the poor fishing is due primarily to the excessive abundance of very small fish, and he suggests that the presence of more fish predators would actually be beneficial. It is regrettable that such an interesting species as the otter is not more highly esteemed and given the protection which it deserves.

SPECIMENS TAKEN: 2.

SOUTHEASTERN MINK

(Mustela vison mink)

DISTRIBUTION: Occurs throughout the region.

HABITAT: Inhabits watercourses whether large or small and the shorelines of ponds and lakes. Wanders extensively and may be found in woods at some distanee from water.

NOTES: The mink is a fairly common resident along the streams and about the lakes, ponds, and marshes of northeastern Pennsylvania. *Mustela vison mink* is the common form throughout the lowlands and apparently the prevalent race elsewhere in the region. The small, dark colored northeastern mink may occur in the highlands, but on this point we have no reliable information. Green (1930) refers the mink of the North Mountain region to the latter race—*Mustela vison vison.*

SPECIMENS TAKEN: 1—Monroc 1.

EASTERN GRAY FOX

(Urocyon cinereoargenteus cinereoargenteus)

DISTRIBUTION: Occurs throughout the region.

HABITAT: Wooded and semi-wooded areas.

NOTES: The gray fox apparently was present in the lowlands of this region even in aboriginal times, but it seems to have been very rare or absent in the highlands until comparatively recent years. The remains of this fox were found in Hartman's Cave, near Stroudsburg, Monroe County (Rhoads, 1903). From old trappers on the Pocono Plateau we learned that it was virtually unknown there a quarter of a century ago, although it was present at the time in the lowlands to the south. Mr. Harrison Slutter states that they first appeared in the Poconos about 1928; then they apparently disappeared again for about five years. Mr. W. J. Bailor, of Thornhurst, recalled that he took his first gray fox on the Pocono Plateau a little over two deeades ago. In the northern counties of Bradford, Susquehanna, and Wayne the situation is essentially similar. Dr. James P. Watson, a practicing veterinarian of Orson, Pennsylvania, stated that there were very few if any gray foxes in that portion of Wayne County twenty years ago. Today the species is more or less common throughout northeastern Pennsylvania.

Trappers throughout the region have stated that the gray fox has been gradually replacing the red fox in their respective territories. Many stated that "years ago" they only took red foxes, now they are getting a very high percentage of the gray species. Mr. George D. Streepy states that about two-thirds of the foxes he has trapped in southwestern Pike County in recent years have been grays. In eastern Bradford County the ratio between reds and grays has been about equal, according to Game Protector Norbert J. Molski, and grays seem to be increasing faster than the reds. The accompanying table shows the number of gray foxes presented for bounty from the counties of this region.

SPECIMENS TAKEN: 2—Monroe 1, Wayne 1.

GRAY FOXES PRESENTED FOR BOUNTY

County	*Area Sq. Mi.*	*1937-38*	*1938-39*	*1939-40*	*1940-41*	*1941-42*	*1942-43*	*1943-44*	*1944-45*	*1945-46*	*1946-47*	*1947-48*	*1948-49*	*1949-50*	*1950-51*
Bradford	1,145	190	130	208	20	175	136	218	305	420	535	423	573	440	427
Carbon	406	73	53	130	44	60	64	55	97	171	210	137	152	168	206
Columbia	479	50	56	90	47	54	70	75	116	279	359	322	281	296	294
Lackawanna	451	91	121	102	93	82	103	128	119	309	304	172	181	162	169
Luzerne	892	168	187	194	97	107	153	198	245	608	636	586	553	486	444
Monroe	623	77	96	136	109	107	210	156	180	334	390	330	392	266	264
Montour	130	2	1	4	—	7	6	14	11	24	27	41	45	45	51
Northumberland ...	454	52	31	59	28	29	32	45	62	144	173	176	126	141	163
Pike	544	240	243	176	195	235	418	285	253	444	340	238	435	311	278
Susquehanna	824	299	270	299	250	205	200	336	330	654	518	232	361	262	189
Wayne	739	255	340	437	421	323	393	477	378	924	872	674	708	477	446
Wyoming	397	97	113	151	70	58	88	102	118	226	242	188	228	162	148
TOTAL		1,594	1,641	1,986	1,374	1,442	1,873	2,089	2,214	4,537	4,606	3,519	4,035	3,216	3,079

EASTERN RED FOX

(Vulpes fulva fulva)

DISTRIBUTION: Occurs throughout the region.

HABITAT: Wooded and semi-wooded areas. It shows a preference for areas where there is an interspersion of woodland, brush, and open fields; but it is not uncommon in extensively forested areas.

NOTES: The red fox probably was not present in this region prior to settlement by the white man. Among the remains of various mammals found in Hartman's Cave, near Stroudsburg, those of the red fox were significantly absent. There is, as a matter of fact, much evidence that our present day red foxes are descended from animals which were introduced from Europe in colonial times (Rhoads, 1903).

In this region, as elsewhere in the state, there was an excessively high population of both species of foxes between 1944 and 1948. A bounty was paid on both red and gray foxes from 1945 to July 31, 1949, on which date that on the red fox was discontinued. The accompanying table shows the number of both species of foxes bountied from the counties of northeastern Pennsylvania from June 1, 1945, to May 31, 1949, and the ratio of gray foxes to red foxes.

County	*Gray Fox*	*Red Fox*	*Gray Fox-Red Fox Ratio*
Bradford	1,951	4,787	1.0 : 2.5
Carbon	670	268	2.5 : 1.0
Columbia	1,240	196	6.3 : 1.0
Lackawanna	966	714	1.4 : 1.0
Luzerne	2,383	665	3.6 : 1.0
Monroe	1,446	1,173	1.2 : 1.0
Montour	137	96	1.4 : 1.0
Northumberland	619	232	2.7 : 1.0
Pike	1,457	749	2.0 : 1.0
Susquehanna	1,765	3,561	1.0 : 2.0
Wayne	3,178	2,248	1.4 : 1.0
Wyoming	884	1,058	1.0 : 1.2
Total	16,697	15,747	1.1 : 1.0

BREEDING: The mating season of the red fox occurs during the winter, and tracks of pairs of foxes travelling together are often observed during the months of January and February. A female taken on April 14, 1950, near Pocono Lake, Monroe County, had six placental scars.

SPECIMENS TAKEN: 1—Monroe 1.

EASTERN BOBCAT

(Lynx rufus rufus)

DISTRIBUTION: Not common but apparently present in most of the extensively wooded parts of the region.

HABITAT: Wooded regions, especially in rocky areas or the vicinity of rock ledges.

NOTES: In former years the eastern bobcat, wildcat, or bay lynx, was a common animal in the forests of northeastern Pennsylvania. In most sections it has now been virtually or actually exterminated, but it still persists in certain of the more heavily wooded and wilder sections. It is still to be found in the North Mountain region, in the Poconos, and in Pike County; and occasionally one is seen in Susquehanna, Wayne, and eastern Bradford County. The animal, however, is sufficiently rare nowadays that whenever one is trapped or shot it generally makes the local newspapers.

From old trappers on the Pocono Plateau we learned that wildcats were still common in that section a quarter of a century ago. Mr. Harrison Slutter, who has trapped a great many of them in the Poconos, states that the adults usually weighed between 20 and 25 pounds. He caught one during the month of January, 1951, the first for many years. Rutledge saw the tracks of one near Pocono Lake on March 10, 1950. Mr. George D. Streepy presented us with the skin and skull of a young female which he trapped in southeastern Pike County during the winter of 1948-1949. From our conversations with trappers, it seems likely that the animal is slowly increasing in numbers, and perhaps actually making a comeback in some sections where it has not been seen for years.

INSECTIVORES

STAR-NOSED MOLE

(Condylura cristata cristata)

DISTRIBUTION: Occurs in suitable habitats throughout the region.

HABITAT: Swales and wet bottomlands, or the banks of streams. Prefers deep mucky soils. Habitat frequently characterized by a growth of swamp grasses, sedges, rushes, and cattail, or thickets of such shrubs as alders, silky dogwood, winterberry, and arrowwood.

NOTES: This mole habitually and characteristically constructs its runways in mucky soils, and very often they are partially or even entirely filled with water. Their workings were observed in a great many places, but the moles were trapped with considerable difficulty. Best success was attained by sinking wooden treadle Museum Special traps level with the bottom of the runways.

On February 15, 1950, Mr. Clyde Miller, of Pocono Pines, Monroe County, found a mole of this species while he was shovelling a deep

snow from his driveway. It was a male, and its tail was greatly enlarged due to an accumulation of fatty tissue. Mr. Miller stated that he had killed another mole of the same kind on the ice at Naomi Lake several years previously. These moles seem to be active near or even above the surface of the ground when the snows are deep enough to prevent the soil from freezing, and their work is much in evidence after the snows melt in the spring. They sometimes riddle lawns in low places or along the banks of streams.

BREEDING: A female taken on July 14, 1950, contained 5 embryos averaging 4 mm. in length.

SPECIMENS TAKEN: 6—Bradford 1, Monroe 5.

HAIRY-TAILED MOLE

(Parascalops breweri)

DISTRIBUTION: Probably throughout the region but collected only in Monroe, Pike, and Wayne counties.

HABITAT: Most common in areas where the soil is fairly deep, friable, and well-drained to dry. Occurs both in wooded and open country.

NOTES: The hairy-tailed mole, as a general rule, inhabits much drier situations than does the star-nosed mole. In many parts of the region it seemed to be rather scarce, perhaps even absent; but it is the "common" mole, and the one with which most persons are more or less familiar. To our knowledge, no specimens of *Scalopus aquaticus* have ever been taken north of the Blue or Kittatinny Mountain range; but Roberts and Early, who have been conducting the mammal survey in southeastern Pennsylvania, have found it to be quite generally distributed to the south of that mountain ridge.

The hairy-tailed mole is the species whose burrows and mounds of earth are most frequently seen here in lawns and gardens, and it sometimes becomes a major pest in such situations. Other species of burrowing animals, particularly short-tailed shrews often use the subterranean galleries excavated by moles. We frequently took both meadow mice and short-tailed shrews in mole runs.

SPECIMENS TAKEN: 8—Monroe 4, Pike 2, Wayne 2.

SHORT-TAILED SHREW

(Blarina brevicauda brevicauda)

DISTRIBUTION: Widely distributed in every county of the region.

HABITAT: Found in virtually every type of terrestrial habitat and about equally common in forested and non-forested areas.

NOTES: The short-tailed shrew is undoubtedly the most common and widely distributed species of mammal in northeastern Pennsylvania. It occurs at all altitudes, in wet or dry situations, and in field and

forest. Where the soils are deep and friable it either constructs its own subterranean runways, or appropriated those made by moles or mice; but it occurs just as commonly in the rocky woodland habitat of the red-backed mice, utilizing the same passageways deep among the rocks. No other species exhibits less restriction by habitat factors, and no one particular habitat seems to be favored by this shrew. During a week's trapping on the sphagnum bog mat at Spruce Pond, Wayne County, a short-tailed shrew was the only small mammal taken. We trapped exceedingly few places where none of these animals were taken, and usually they were among the most abundant mammals in our traps.

From June until late fall a great many subadult individuals were regularly taken in the traps, but we have never taken what might be termed a "baby" short-tailed shrew. Apparently they do not do much wandering until they are at least two-thirds grown. This shrew is active at all hours of the day and night, and frequently one or more individuals were taken before we completed setting our trap lines.

FOOD HABITS: The short-tailed shrew is a voracious little beast, but it performs an economic service to man through its destruction of insects and their larvae. They frequently destroyed the specimens of mice caught in our traps, sometimes leaving practically nothing but a bedraggled piece of skin.

BREEDING: Most male specimens showed definite signs of being in a breeding condition by early or mid-March. The first litters are apparently born sometime during the month of April, and several litters probably follow during the summer months. We found no pregnant females, and very few that were lactating after mid-September. Data on embryos found in the females examined are presented in the following table.

	Number of embryos	*Size*
1950, April 25	4	10 mm.
June 21	4	8 mm.
July 18	5	12 mm.
August 15	4	8 mm.
1951, April 17	8	4 mm.

SPECIMENS TAKEN: 696—Bradford 53, Carbon 14, Columbia 1, Luzerne 50, Monroe 124, Montour 3, Northumberland 12, Pike 71, Sullivan 16, Susquehanna 140, Wayne 201, Wyoming 11.

LITTLE SHORT-TAILED SHREW

(Cryptotis parva parva)

DISTRIBUTION: Unknown. Known at present only from Columbia County.

HABITAT: Open fields, generally those in cultivation or in short grasses.

NOTES: The only specimen of this shrew taken by us was obtained on a farm about 3¾ miles east of Benton, Columbia County. It was taken on a hillside in a snap trap baited with bacon rind, and placed at the edge of a cornfield which adjoined a strip of unmowed meadow. This individual was caught on October 25, 1949, the first night traps were operated, and no more were taken during the week. The specimen was a male in breeding condition. Fisher's deer mice, prairie deer mice, house mice, and short-tailed shrews were taken in the same locality.

SMOKY SHREW

(Sorex fumeus fumeus)

DISTRIBUTION: Generally distributed throughout the region but apparently more common at higher elevations.

HABITAT: Most common in forest habitats—either coniferous or deciduous—but often present in fields or marshy areas. The optimum habitat appears to be rocky woodlands, or those with a deep accumulation of leaf litter, rotten stumps, and logs.

NOTES: Although the smoky shrew has a much wider distribution than any of the other long-tailed shrews, it was nowhere found in very large numbers. It was very rare, or even absent, in many places where the habitat was judged to be nearly or quite optimum. This shrew was often found in the same habitat as *Sorex cinereus*, and it usually occupied the same sites as *Sorex dispar*.

BREEDING: Most of the males taken during the month of April were evidently in a breeding condition. Lactating females were frequently taken between early May and late September. The data on embryos or placental scars found in the females examined are given in the following table.

Date	*Number of embryos*	*Size*	*Number of scars*
1950, April 23	6	–1 mm.	
September 28			3

SPECIMENS TAKEN: 82—Bradford 3, Carbon 13, Luzerne 14, Monroe 17, Northumberland 3, Pike 8, Sullivan 7, Susquehanna 7, Wayne 10.

MASKED SHREW

(Sorex cinereus cinereus)

DISTRIBUTION: Occurs throughout the region but most common at higher elevations.

HABITAT: Wooded and semi-wooded areas are the usual habitats, but it sometimes occurs in bogs, brushy fields, and sedge-grass meadows. It apparently is most common in cool, moist, and rocky woodlands.

NOTES: This little shrew was frequently taken on the Pocono Plateau, but elsewhere it was usually quite scarce. It was nowhere present in such numbers as were encountered on Laurel Hill Mountain in southwestern Pennsylvania (Grimm and Roberts, 1950). The greatest single concentration found during the period of this study was on the bog mat at Bruce Lake, Pike County, where a total of twelve were taken between August 29 and September 3, 1949. It was the most common small mammal in the bog. Although many apparently optimum habitats were trapped in the North Mountain region during the fall of 1949, and in eastern Bradford, northern Susquehanna, and northern Wayne counties during the summer of 1950, the species was evidently very rare or absent.

BREEDING: Males taken on the Pocono Plateau during the month of April were in breeding condition. Lactating females were observed throughout the summer months. Data on embryos found in the females examined are presented in the following table.

Date	*Number of embryos*	*Size*
1949, September 3	3	5 mm.
1950, May 16	4	5 mm.

SPECIMENS TAKEN: 53—Luzerne 2, Monroe 27, Pike 17, Sullivan 3, Wayne 1, Wyoming 3.

BIG-TAILED SHREW

(Sorex dispar)

DISTRIBUTION: Known at present from Carbon, Luzerne, and Wayne counties in the present region. Evidently rare and local but probably of much wider distribution than present data signifies.

HABITAT: Cool, moist, and exceedingly rocky sites; generally dominated by yellow birches, hemlocks, mosses, and ferns.

NOTES: The big-tailed shrew was found in comparatively few of the localities which were trapped; and none were taken in many of the apparently suitable habitats. This shrew is invariably associated with those places where residual blocks and fragments of sandstone and conglomerate rock have accumulated to a great depth, forming an intricate network of deep, cool, and moist passageways. In most places where it was taken a thin cover of humus had accumulated over or between the rocks, supporting ferns and such rock-loving trees as the yellow birch and hemlock. Apparently the animal spends most of its time in those subterranean galleries, occasionally making short excursions to the surface. Red-backed mice invariably were associated with it, and quite often the short-tailed and smoky shrews. On North Mountain it and the rock vole were taken within a few feet of each other;

and Dr. Earl L. Poole told us that he had taken *Sorex dispar* at Island Lake, Wayne County, where the rock vole has also been taken.

SPECIMENS TAKEN: 7—Carbon 3, Luzerne 4.

WHITE-CHINNED WATER SHREW

(Sorex palustris albibarbis)

DISTRIBUTION: Known to occur only in the North Mountain Region, on the Pocono Plateau, and in southwestern Pike County; but probably of much wider distribution in the higher parts of the region.

HABITAT: Usually fast-flowing, rocky-bedded streams of the Canadian Zone and its fringes.

NOTES: The water shrew leads a more or less aquatic life, and the majority of our specimens were taken along small streams in wooded areas. The typical habitat was a small stream with hemlocks, spruces, and rhododendrons crowding the banks; the bed strewn with rocks, which were often covered with water moss. Our best success in taking this shrew was attained by placing mouse traps, baited with small pieces of bacon rind, in crevices where the roots of trees or the stream bank itself overhung the water's edge. Apparently the animals frequently travel under such a canopy, investigating every nook within their range. Rutledge took two specimens in a trap thus located within three days. We obtained a few specimens along small streams flowing through comparatively open areas, but we had no success whatsoever in trapping them along the shore lines of lakes. Many apparently suitable habitats along streams were likewise trapped without success, and the distribution of the animal was judged to be scattered and local.

BREEDING: Males taken on the Pocono Plateau in Monroe County on April 19 and 20, 1950, were in breeding condition. No data were obtained from any of the females examined.

SPECIMENS TAKEN: 16—Luzerne 1, Monroe 11, Pike 2, Sullivan 1, Wyoming 1.

MEASUREMENTS: Average of 6 males: total length 149.5 mm. (144-155 mm.), tail length 70 mm. (66-75mm.), hind foot 20 mm., weight 13 grams (11.5-17.5 grams); average of 10 females: total length 150 mm. (142-160 mm.), tail length 69.5 mm. (65-75 mm.), hind foot 20 mm., weight 12.5 grams (10.0-16.0 grams).

BATS

LITTLE BROWN BAT

(Myotis lucifugus lucifugus)

DISTRIBUTION: Widely distributed and common throughout the region.

HABITAT: When flying this bat occurs nearly anywhere, but large numbers were invariably seen feeding at dusk over lakes and

ponds. By day it retires to dark places among rocks or about buildings. In winter it generally hibernates in caves.

NOTES: The little brown bat is undoubtedly the commonest species of bat in the present region. In August, 1949, literally thousands of them were spending the day in the belfry of the Moravian Church, about 4 miles southeast of Greentown, Pike County. Rutledge caught fifty or more of them by hand, and we found that both sexes were present. The species is very common on the Pocono Plateau during the summer months; and they were abundant at Laurel Lake, Susquehanna County, and at Lake Como, Wayne County, during the late summer and fall of 1950. At the latter locality they decreased appreciably in numbers shortly after the first of October when the nights began to turn cold.

On March 15, 1950, a series of hibernating little brown bats, consisting of 12 males and 6 females, was collected in Hartman's Cave on Godfrey Ridge near Stroudsburg, Monroe County. The animals were in a state of stupor, and they appeared to be quite hoary owing to the condensation of minute water droplets on their fur.

SPECIMENS TAKEN: 70—Monroe 18, Pike 50, Wayne 2.

NEW YORK PIGMY BAT

(Pipistrellus subflavus obscurus)

A male specimen of this bat was taken in Hartman's Cave near Stroudsburg, Monroe County, on March 15, 1950.

BIG BROWN BAT

(Eptesicus fuscus fuscus)

DISTRIBUTION: Occurs throughout the region.

HABITAT: In feeding this bat ranges widely over field and forest. By day it retires to dark recesses about buildings or crevices among rocks.

NOTES: While the big brown bat seems to be widely distributed in the region, it nowhere was observed in such large numbers as the little brown bat; but like the latter species, it was often seen cruising over the lakes at twilight. Green (1930) recorded it among the mammals of the North Mountain region. We frequently observed it on summer evenings on the Pocono Plateau.

SPECIMENS TAKEN: 4—Monroe 2, Pike 1, Susquehanna 1.

NORTHERN RED BAT

(Lasiurus borealis borealis)

We took no specimens of this bat, and its status in the region is uncertain. It should, and probably does, occur throughout this section. Green (1930) listed it among the mammals of the North Mountain region.

HOARY BAT

(Lasiurus cinereus)

Green (1930) listed this species among the mammals of the North Mountain region. None were collected, nor were any positive sight records made during the present study.

NON-GAME RODENTS

NORTHEASTERN CHIPMUNK

(Tamias striatus lysteri)

DISTRIBUTION: Occurs throughout the region.

HABITAT: Wooded or semi-wooded areas. The habitat must include rocks, stumps, logs, etc., to provide cover. Burrows may be dug in sandy or loamy soils.

NOTES: The chipmunk is common in most suitable habitats in northeastern Pennsylvania. Only in northern Susquehanna County, in the vicinity of Laurel Lake, did we find them to be relatively scarce during the past two years. At Pocono Lake, Monroe County, they were occasionally observed as late as mid-November on warm, sunny days; and both in 1950 and in 1951, occasional individuals were seen abroad during the latter part of February and early March.

FOOD HABITS: Chipmunks feed on a variety of seeds, tubers, acorns, and various small nuts such as hazelnuts and beechnuts. During the summer months they vary their diet with insects. On June 27, 1950, along the Susquehanna River near Wyalusing, dobson flies were emerging in some numbers, and chipmunks were observed eating them occasionally. In late summer and early fall, many of the specimens taken were carrying cherry pits or acorns in their cheek pouches. Although the animal disappears during the colder part of the winter, it apparently is not one of the sound sleepers, and the stores of food laid away during the late summer and fall months are undoubtedly largely consumed during the winter.

BREEDING: Breeding data found in the females examined are as follows:

Date	*Number of Placental Scars*
1949, August 9	4
August 25	4
October 20	5
1950, June 20	7
June 27	7
August 23	7

SPECIMENS TAKEN: 40—Bradford 6, Luzerne 3, Monroe 3, Pike 10, Sullivan 1, Susquehanna 2, Wayne 12, Wyoming 3.

FISHER'S CHIPMUNK

(Tamias striatus fisheri)

Dr. Arthur H. Howell, in his *Revision of the American Chipmunks* (North American Fauna Number 52) lists the following localities in northeastern Pennsylvania for this race:

Bushkill Creek, 7 miles east of Cresco, Monroe County.

Harvey's Lake, Luzerne County.

Saylorsburg, Monroe County.

EASTERN FLYING SQUIRREL

(Glaucomys volans volans)

DISTRIBUTION: Occurs locally throughout the region.

HABITAT: Chiefly wooded areas although they sometimes make their abode in more or less isolated shade or ornamental trees. Optimum habitat is mature or all-age forest stands containing mast producing trees such as oaks and beeches and suitable natural cavities for den sites.

NOTES: No large population of this little nocturnal animal was found during the period of this study, and it was evidently not present in many apparently suitable habitats. Local residents in most sections were acquainted with it, however, and it seems likely that the population was only temporarily low. It has a much wider distribution in the region than does the Mearns' flying squirrel.

FOOD HABITS: Acorns, beechnuts, and cherry pits seem to be its staple foods. It probably, on occasion, varies this diet with meat as it was frequently taken in traps which were baited with small scraps of bacon.

BREEDING: There are probably two litters of young during the year. A male taken on January 18, 1950, was in breeding condition. A female taken on August 10, 1950, had three embryos which averaged 14 mm. in length; and another, taken on October 14, 1949, showed 7 placental scars, probably representing the number of young in two broods.

SPECIMENS TAKEN: 9—Monroe 4, Sullivan 3, Susquehanna 1, Wayne 1.

MEARNS' FLYING SQUIRREL

(Glaucomys sabrinus macrotis)

DISTRIBUTION: Occurs locally throughout the northern portion of the region and southward on the Pocono Plateau.

HABITAT: Coniferous forests or mixed forests of conifers and northern hardwoods. Optimum habitat is virgin or all-age forest stands with mast-producing trees and dead trees or natural cavities to provide den sites.

NOTES: It is strange indeed that this flying squirrel was not actually discovered in the state until a little more than two decades ago, for it seems to be at least locally common and rather widely distributed in the northern counties. It is most common at higher elevations, but we have taken specimens in the Susquehanna Valley in the vicinity of Wyalusing and in the Delaware Valley north of Equinunk, Wayne County. On the Pocono Plateau, and elsewhere, it was taken in the same woods as the smaller eastern flying squirrel. It is nocturnal in its habits, and its presence may easily be overlooked.

FOOD HABITS: Acorns, beechnuts, cherry pits, and the seeds of various coniferous trees are evidently the staple foods of this flying squirrel. It probably varies this diet with meat on occasion. Hamilton (1943) states that Adirondack trappers often find it necessary to clean out the flying squirrels in the neighboorhood before furbearers can be taken, for they rifle the cubbies and devour the bait.

SPECIMENS TAKEN: 16—Bradford 2, Luzerne 1, Monroe 7, Sullivan 1, Wayne 4, Wyoming 1.

ALLEGHENY WOOD RAT

(Neotoma magister)

DISTRIBUTION: Found locally in the Poconos, and probably also in suitable habitats in the Susquehanna and Delaware valleys.

HABITAT: Dry rock cliffs, outcrops, or rock slides in forested areas.

NOTES: The wood rat is apparently rare and local in northeastern Pennsylvania. Mr. Harrison Slutter stated that 20 or 25 years ago he caught a good many of them in or about the Boulder Fields in eastern Carbon County when he was trapping for bobcats in that area. Whether or not they still exist there we cannot say. In the same county, at nearby Split Rock, we found several piles of old scats about that massive residual rock, but our efforts to get any specimens of the animals were fruitless. We found no indication of their current presence in that area. Mr. Wilmer C. Richter, Leader of Pittman-Robertson Project 26-R, told us that he caught one in a box trap set for rabbits on State Game Lands 187 in Luzerne County. In the vicinity of Wyalusing, Bradford County, and Equinunk, Wayne County, we talked with trappers who were apparently familiar with this rodent; and there is a good possibility that they may inhabit some of the cliffs along the river hills. In many places it looks like excellent wood rat habitat. Green (1930) made no mention of the presence of the animal in the North Mountain region, and we found no evidence of their presence about any of the rocky sites we examined.

LE CONTE'S DEER MOUSE

(Peromyscus maniculatus gracilis)

DISTRIBUTION: At higher elevations throughout the region.

HABITAT: Cool, moist forests. Chiefly in the forests of the beech-birch-maple and coniferous types. The habitat, in general, is that occupied by the red-backed mouse in this region.

NOTES: The long-tailed, big-eared deer mice of this region afford somewhat of a problem as far as their identity is concerned. Green (1930) referred his North Mountain specimens to the race *gracilis;* and Dr. Doutt has provisionally, at least, considered all of our specimens as belonging to that race. It seems highly probable, however, that most specimens are intergrades between *gracilis* and *nubiterrae,* the race which occupies the Allegheny Mountain region of the state.

These mice are found only at higher elevations in cool, moist, and generally rocky situations. There were exceedingly few places where it occurred exclusively, for Fisher's Deer Mouse *(Peromyscus leucopus noveboracensis)* most often occupied the same habitats. At higher elevations on North Mountain, however, the LeConte's Deer Mouse was decidedly the most common species.

BREEDING: Breeding data taken from the females examined are given in the following table.

Date	*Number of embryos*	*Average size*	*Number of placental scars*
1949, August 3	5	12 mm.	
August 3	4	12 mm.	
August 5	4	15 mm.	
August 9	5	11 mm.	
August 13			5
August 28	5	25 mm.	
August 29			6
September 1	4	23 mm.	
September 16			5
September 17			6
September 20			6
September 20			5
September 20			5
September 20			5
September 28			7
September 30			5
September 30			5
October 12			4
October 14			5
October 14			4
1950, July 25	4	8 mm.	
July 26	6	23 mm.	
July 26			5
August 8	4	5 mm.	
August 8	6	22 mm.	
August 8	6	10 mm.	
August 8			7
August 8	6	7 mm.	
August 8			6
August 9	5	7 mm.	
August 10	3	7 mm.	

Date	Number of embryos	Average size	Number of placental scars
August 15	5	5 mm.	
August 15	5	11 mm.	
August 15	5	9 mm.	
August 15	5	12 mm.	
August 29	6	8 mm.	
September 12	6	4 mm.	
September 12	6	8 mm.	
October 19			5

SPECIMENS TAKEN: 104—Carbon 5, Luzerne 10, Monroe 22, Pike 25, Sullivan 4, Susquehanna 26, Wayne 8, Wyoming 4.

PRAIRIE DEER MOUSE

(Peromyscus maniculatus bairdii)

DISTRIBUTION: Probably confined to the Susquehanna Valley and the counties to the westward.

HABITAT: Dry and open situations with only a moderate to sparse ground cover of herbaceous plants. Rocky and exposed highway cuts appear to afford an excellent habitat.

NOTES: During the course of the field work conducted by the mammal survey parties, the known range of this mouse has been gradually extended eastward. In northeastern Pennsylvania it has now been recorded as far east as the Susquehanna River. Two males were trapped on Shamokin Island, Northumberland County, on April 28-29, 1951. The previous summer a few were taken in the vicinity of Wyalusing, Bradford County, on the east side of the river. Near Benton, Columbia County, a few were taken in a hilltop corn field during the month of October, 1949. In the latter habitat they were associated with both *Peromyscus leucopus* and the house mouse, although much less common than either of them. We failed to take any specimens of prairie deer mice in apparently suitable habitats east of the Susquehanna Valley.

The chosen habitat of this mouse is one that a casual observer would deem to be well-nigh uninhabitable. It shuns dense cover of any kind. A dry, rocky bank in open country, with a sparse cover of herbaceous vegetation—sweet clovers and sundry weeds—is highly favored. Near Wyalusing, it was taken along the right-of-way of the Lehigh Valley Railroad, in spots where the vegetation was thinnest. Apparently a crevice among the rocks, a few loose boards, or some other scattered bit of trash are all that it desires in the way of cover.

BREEDING: The following data on embryos were obtained from the females examined during this study.

Date	*Number of embryos*	*Size of embryos*
1949, October 27	5	20 mm.
1950, July 13	4	18 mm.

SPECIMENS TAKEN: 10—Bradford 6, Columbia 2, Northumberland 2.

FISCHER'S DEER MOUSE

(Peromyscus leucopus noveboracensis)

DISTRIBUTION: Occurs throughout the region and at all elevations.

HABITAT: Wooded and semi-wooded areas. Often common in thickets and brushy fencerows, occasionally straying to nearby open areas. Sometimes common in corn fields, particularly during the fall months.

NOTES: Next to the short-tailed shrew, this deer mouse is the most abundant and widely distributed of our small mammals. It occurs at all known elevations in northeastern Pennsylvania, and in virtually every forest type. In rural districts it commonly invades cabins and houses. In the late summer and early fall many of these mice are heavily infested with the larvae of a warble fly *(Cuterebra)*.

FOOD HABITS: Deer mice usually carry their food to some sheltered spot before consuming it; and they generally leave little piles of seed hulls at their middens beneath projecting rocks, logs, or about old tree stumps. In the summer they consume many insects, but seeds of various kinds constitute their year-round staple diet. Seeds of the various species of wild cherries are a favorite item.

BREEDING: Juvenile individuals have been taken occasionally as early as April. Males taken during the latter part of March or early in April are invariably in breeding condition. The breeding data taken from the females examined are presented in the following table.

Date	*Number of embryos*	*Average size*	*Number of placental scars*
1949, August 23			3
August 28	4	6 mm.	6
September 15			5
September 20	8	1 mm.	
September 22			4
October 12			5
October 28	4	4 mm.	

Date	Number of embryos	Average size	Number of placental scars
1950, May 4			6
May 6	5	8 mm.	
May 10	6	4 mm.	
May 16			5
May 17			3
May 17			6
May 24	3	13 mm.	
June 9	5	2 mm.	
June 9	5	12 mm.	
June 21	4	15 mm.	
June 28	5	4 mm.	8
June 28			4
June 29	3	12 mm.	
July 5	4	5 mm.	
July 6	4	18 mm.	
July 13	3	7 mm.	
July 14	2	14 mm.	
July 14	4	5 mm.	
July 25	5	8 mm.	
July 25			5
July 25	6	6 mm.	
July 26			7
July 26	7	7 mm.	
July 26	6	5 mm.	
August 29			6
August 31			5
August 31	5	12 mm.	
September 8	6	8 mm.	
September 12			7
September 12			6
September 15	2	10 mm.	
September 16	4	5 mm.	
September 26			6
September 26	6	13 mm.	
September 26			5
September 26	5	1 mm.	
September 26			4
October 12	5	13 mm.	
October 14	4	25 mm.	
October 17	6	18 mm.	
October 18	5	16 mm.	
October 18	5	22 mm.	
1951, April 12	5	1 mm.	
April 12	5	2 mm.	
April 14	5	20 mm.	
April 14	4	–1 mm.	
April 17	6	–1 mm.	
April 17	5	3 mm.	
April 17	6	15 mm.	
April 17	4	23 mm.	
April 18	4	22 mm.	
April 18			5
April 18	4	15 mm.	
April 18	5	3 mm.	
April 19	5	12 mm.	
April 19	6	1 mm.	
April 26			5
May 1	5	15 mm.	
May 4	6	15 mm.	

SPECIMENS TAKEN: 321—Bradford 51, Carbon 24, Columbia 5, Luzerne 13, Monroe 72, Montour 3, Northumberland 41, Pike 32, Sullivan 10, Susquehanna 25, Wayne 38, Wyoming 7.

GAPPER'S RED-BACKED MOUSE

(Clethrionomys gapperi gapperi)

DISTRIBUTION: Found quite generally in the mountainous parts of the region, but confined to the Canadian and Alleghenian zones.

HABITAT: Cool, moist, and generally rocky woodland is the optimum habitat of the red-backed mouse. It is most numerous in coniferous or mixed forests, particularly where ferns and mosses are abundant in the understory. At times it is quite common in bogs, and it has been taken in scrub oak barrens on the Pocono Plateau.

NOTES: The red-backed mouse is preeminently a forest dweller, and it seldom strays far from its preferred habitat. However, on December 3, 1949, Mr. Harrison Slutter, of Locust Ridge, Monroe County, brought us three mice which he had trapped in his house, two of them being of this species. Occasionally we have taken them in small clearings, or in field areas close to woods, along with the meadow mouse. Several red-backed mice were trapped on the floating bog mat at Bruce Lake, Pike County, but the majority of them were taken in or close to the little thickets formed by the black spruces and tamaracks. On one occasion a red-back was taken in a rat trap placed about 3 feet from the ground on the vertical trunk of a tree.

These voles are active both by day and by night, but the peak of their activity, as judged by trap line records, seems to occur between sunset and daybreak. An interesting account of its vocal efforts was recorded by Rutledge, Assistant Project Leader, on December 3, 1949. He was hunting deer at the time and sat down on a pile of cordwood in a little clearing among the hemlocks, white pines, and red spruces. He presently heard a squeaking sound coming from an adjacent pile of wood. A red-back subsequently ran out to the end of one of the logs, stood on its hind feet, and uttered a series of bird-like chirps. It was soon answered by a second animal, whose head appeared but a few inches from the observer's feet. This individual also sat up, placed both of its fore feet on another log, uttered four high-pitched notes, and suddenly disappeared. Although the animals were not seen again, they could be heard scurrying among the logs and chirping occasionally. The call was a series of high-pitched notes given in rapid succession and gradually descending in scale.

FOOD HABITS: Red-backed mice apparently feed on a variety of herbaceous plants found in their forest habitat, as well as the seeds of various shrubs and trees. The seeds of the hemlock, white pine, and spruces seem to be a staple food in many localities. Fragments of various wood ferns are often found in their subterranean runways among the rocks. Their food habits rarely if ever conflict with man's interests.

BREEDING: The breeding season apparently extends from late March or early April until the latter part of October, during which time several litters are born. Breeding data obtained during the period of this survey is presented in the following table.

Date	*Number of embryos*	*Average size*	*Number of placental scars*
1949, August 9			4
August 23	3	7 mm.	
August 30			5
September 20	3	9 mm.	
September 22			4
September 27			5
September 27	5	22 mm.	
September 27			6
September 28	5	11 mm.	
September 28			7
October 7			5
October 8	4	20 mm.	
October 11	5	4 mm.	
1950, April 9	3	1 mm.	
May 1	4	14 mm.	
October 11	5	20 mm.	
November 14			4
November 14			5
1951, April 14	5	7 mm.	

SPECIMENS TAKEN: 219—Carbon 25, Luzerne 29, Monroe 106, Northumberland 2, Pike 22, Sullivan 15, Susquehanna 1, Wayne 19.

PENNSYLVANIA MEADOW MOUSE

(Microtus pennsylvanicus pennsylvanicus)

DISTRIBUTION: Occurs at least locally in every part of the region.

HABITAT: Optimum habitat for the species is unpastured meadow and swale with a variety of grasses, sedges, rushes, and other herbaceous plants. Under population stress it may occupy grassy habitats everywhere.

NOTES: The meadow mouse is the familiar "field mouse" which farmers often encounter in the hay meadows or beneath the shocks of grain at threshing time. During those periods when the population of this vole is high, it occurs almost everywhere about the farm—in the meadows and orchards, in the grain fields, and along virtually every unmowed fencerow. During the past two years we found many places throughout northeastern Pennsylvania where old sign in the form of networks of runways, scats, and cuttings attested to the former abundance of this rodent, but the animals had apparently vanished. The population throughout the period of this study was almost universally low, but there were indications of an increasing population in the spring of 1951.

Most of the specimens taken by us were obtained in small swale areas, often along the creeks or the shores of lakes where there was an abundance of succulent herbaceous vegetation. The species occurs at all elevations, from the valleys of the Susquehanna and Delaware rivers to the summit of North Mountain. At the latter place, and at Bruce Lake in Pike County, these voles were found in old beaver meadows, bogs, or grassy swales which were isolated for many miles by unbroken forest. Such remote swale and bog areas undoubtedly constituted its primeval habitat.

FOOD HABITS: When meadow mice are abundant, they often cause serious injury to various agricultural crops. Orchards and nurseries are sometimes damaged severely during the winter seasons, when these voles attack the trees to feed on the cambium and inner bark, and large trees are not infrequently killed by girdling. Their principle food, however, is herbaceous vegetation, particularly grasses, sedges, and rushes. In order to reach the more succulent portions of the plant the taller stalks are cut off and then cut up into short sections. These cuttings are usually common in the runways of *Microtus*.

BREEDING: We found no evidence of breeding throughout the winter months, but no winter specimens were examined from the lower elevations where this would more likely occur. There is evidence that breeding occasionally takes place during the latter part of the winter, even on the Pocono Plateau, for a female taken there on February 28, 1951, had five embryos. Several litters are produced during the period from March to October. Breeding data obtained during this survey is presented in the following table.

Date	*Number of embryos*	*Average size*	*Number of placental scars*
1949, August 10			4
August 30			5
August 30			4
September 3	4	18 mm.	
September 3	5	13 mm.	
September 11	3	7 mm.	
October 5	5	30 mm.	
1950, May 11	5	16 mm.	
May 16	5	12 mm.	
May 17	6	26 mm.	
May 23			6
June 8	5	15 mm.	
June 22	4	20 mm.	
June 28	8	14 mm.	
July 19	6	5 mm.	
July 27			6
July 27	4	5 mm.	
August 4	5	7 mm.	
1951, February 28	5	–1 mm.	
April 18	5	2 mm.	
April 19	6	15 mm.	
April 25	5	18 mm.	
April 27	5	22 mm.	
April 28	5	15 mm.	

SPECIMENS TAKEN: 114—Bradford 15, Carbon 9, Monroe 35, Montour 1, Northumberland 13, Pike 19, Susquehanna 12, Wayne 3, Wyoming 7.

ROCK VOLE

(Microtus chrotorrhinus chrotorrhinus)

DISTRIBUTION: Known to occur on North Mountain, and locally in Wayne County. Evidently very rare and local; perhaps the rarest of our small rodents.

HABITAT: Cool, moist, and very rocky woodlands of the Canadian Zone and its fringes.

NOTES: The rock vole is aptly named for its haunts are invariably extremely rocky, with intricate, deep, moist, and cool passageways. In Ganoga Glen, Luzerne County, it was taken in the steep-sided, rocky gorge where water continuously dripped from the mossy and fern-studded cliffs beneath the towering hemlocks and northern hardwoods. On the summit of North Mountain it occurred in accumulations of rock dominated for the most part by small yellow birches, maples, hemlocks, and mountain ash. Red-backed mice were invariably trapped in the same habitats, and the big-tailed, smoky, and short-tailed shrews were often among its associates. Although Hamilton (1943) states that it is a comparatively easy matter to trap out whole families of this vole, we never succeeded in obtaining more than a single individual at any given locality. Many apparently suitable habitats were trapped without success. Dr. Earl L. Poole has advised us that he has taken it at Gas Hollow in southern Wayne County, the nearest it has been taken to the Pocono Plateau that we know of.

FOOD HABITS: Although we were unable to obtain any definite data on the food habits of this vole, we strongly suspect that they are quite similar to those of the red-backed mouse.

BREEDING: A female taken on North Mountain, September 30, 1949, showed 5 placental scars, and another taken at Island Lake, Wayne County, on September 27, 1950, had 3 such scars. It apparently is much less prolific than its close relative, the meadow mouse.

SPECIMENS TAKEN AND MEASUREMENTS:

County	*Date*	*Sex*	*Total Length*	*Tail Length*	*Hind Foot*	*Weight*
Luzerne ...	Sept. 29, 1949	Male	143 mm.	41 mm.	19 mm.	24.0 grams
Luzerne ...	Sept. 30, 1949	Female	137 mm.	40 mm.	20 mm.	23.0 grams
Luzerne ...	Oct. 4, 1949	Female*	109 mm.	30 mm.	20 mm.	13.0 grams
Sullivan	Oct. 18, 1949	Male	152 mm.	47 mm.	20 mm.	30.0 grams
Wayne	Sept. 27, 1950	Female	148 mm.	45 mm.	18 mm.	30.5 grams

* Juvenile

NORTHERN PINE MOUSE

(Pitymys pinetorum scalopsoides)

DISTRIBUTION: Probably occurs at least locally throughout the region.

HABITAT: Generally in wooded or semi-wooded areas where the soils are deep, loamy, or sandy. Occasional in fields or in rocky woodlands.

NOTES: The pine mouse is apparently scarce in northeastern Pennsylvania at the present time. Only two specimens were taken during the entire two-year period of this study. These were trapped in a tract of virgin hemlocks and northern hardwoods on the property of the Buck Hill Falls Association, not far from the falls on Buck Hill Creek, Monroe County. It was a typical red-backed mouse habitat—very rocky, with an abundance of mosses and ferns in the understory. Red-backed mice were, in fact, quite common.

Along the flood plain of Pocono Creek, near Tannersville, Monroe County, subterranean runways, evidently made by this vole, were extremely abundant. The burrows ramified the sandy loam soil everywhere, both in thickets and in old fields. Apparently the animals which made them must have been very abundant at some time in recent years. The short-tailed shrew, however, was the only mammal taken in these runways during our trapping operations. Dr. Doutt examined the locality later and stated that, in his opinion, the burrows were those of the pine mouse.

SPECIMENS TAKEN: 2—Monroe 2.

COOPER'S LEMMING MOUSE

(Synaptomys cooperi cooperi)

DISTRIBUTION: Probably occurs, at least locally, throughout the region.

HABITAT: Moist to dry, grassy or grassy and weedy areas. Occasional in woods or in semi-wooded areas.

NOTES: If the lemming mouse is ever a common inhabitant of northeastern Pennsylvania, it most certainly was at a very low period in its population cycle during the past two years. Many apparently suitable habitats were investigated without finding a trace of sign indicating their presence; but, in a few places, we found indications that they had been present at some time in recent years. One specimen was taken along a moist roadside bank near Wyalusing, Bradford County, on July 14, 1950. It was in a heavily wooded section, but a dense cover of grasses and other herbaceous vegetation grew on the open bank bordering the highway. On October 31, 1950, a specimen was taken along Route 940, between Blakeslee and Pocono Lake, Monroe County, in a small swale area which also produced a few meadow mice, a red-backed mouse, star-nosed moles, short-tailed shrews, and a water shrew. On November 8, another was taken a short distance from this site—along the banks of Davey Run. In the latter place there was

practically no herbaceous cover. Both of the latter specimens were sub-adult females.

Dr. Doutt has identified our specimens as belonging to the race *cooperi*. Dr. A. Brazier Howell, in his *Revision of the American Lemming Mice* (North American Fauna Number 50), has referred a specimen taken near Cresco, Monroe County, to *Synaptomys cooperi stonei*, Green (1930) has referred his North Mountain specimens to the race *cooperi*.

SPECIMENS TAKEN: 3.

HOUSE MOUSE

(Mus musculus)

DISTRIBUTION: Occurs throughout the region. Introduced from Europe.

HABITAT: Often common about human habitations, barns, and granaries. Locally common to abundant in cultivated fields.

NOTES: Feral house mice were often taken in cultivated fields, particularly in corn fields. At our permanent headquarters in Pocono Lake, Monroe County, not a single individual was ever taken. Deer mice *(Peromyscus leucopus)* frequently invaded the dwelling during the colder months, but house mice were neither seen nor trapped.

BREEDING: The house mouse is a prolific breeder, and feral females were found producing rather large litters of young from early spring until late fall. Data on embryos found in the females examined are given in the following table.

Date	*Number of embryos*	*Size of embryos*
1949, October 25	7	3 mm.
1950, May 16	5	14 mm.
June 8	8	4 mm.

SPECIMENS TAKEN: 40—Bradford 10, Columbia 13, Pike 5, Wayne 12.

NORWAY RAT

(Rattus norvegicus)

DISTRIBUTION: Occurs throughout the region. Introduced from Europe.

HABITAT: Often a pernicious pest about human habitations and farm buildings. Generally abundant about town and city dumps, and often common in fields and along streams.

NOTES: The Norway rat is found about human habitations virtually everywhere, even in isolated sections. In June 1950, we found that they were quite common along the Susquehanna River in the vicinity of Wyalusing, Bradford County. At least a half dozen indi-

viduals were trapped in the immediate vicinity of the cabin, and their tracks were seen continuously in the mud along the river. In the fall of the same year, we found that they were by no means uncommon about the shore of Lake Como, Wayne County. At Pocono Lake they periodically invaded the buildings.

BLACK RAT

(Rattus rattus rattus)

Rhoads (1903) predicted that the introduced black rat would become permanently established in the upper transition and Canadian life zones of the state, but his prediction has not been fulfilled. We found no evidence that this rat is present anywhere in the region today, although Rhoads stated that it occurred in Lackawanna, Wayne, Pike, and Monroe counties a half century ago. He stated that it was predominant in the barns and houses of the backwoods in 1896, during his travels in the Poconos. Today it has apparently been supplanted by the Norway rat, perhaps having been driven out by that species. Green (1930) made no mention of the black rat in the North Mountain region.

MEADOW JUMPING MOUSE

(Zapus hudsonius hudsonius)

DISTRIBUTION: Occurs throughout the region in suitable habitats.

HABITAT: Meadows, swales, and thickets at all elevations. Moist depressions and wet bottomlands are preferred to drier sites on slopes. Occasional in openings in wooded areas where there is some ground cover of grasses and other herbaceous vegetation.

NOTES: The woodland and meadow jumping mice were seldom taken in the same habitat, although this occurs occasionally where open grassy areas or swales adjoin the habitat of the woodland species. We found the meadow jumping mouse to be most common in sedge-grass swale areas, or in wet thickets where the herbaceous vegetation was dense. They were generally concentrated in such areas, and rather local in their distribution. Several individuals were taken on the sphagnum bog mat at Bruce Lake, Pike County, where they were associated with the masked shrew, meadow mouse, and red-backed mouse.

It apparently goes into hibernation during the month of October and resumes its activities in May. We took our first specimen on May 13, 1950, near Kresgeville, Monroe County, at an elevation of about 700 feet. At that time they were probably not yet active at higher elevations. The latest date on which it was taken in the fall was on October 7, 1949, near Ganoga Lake at an elevation of 2,240 feet. Of course, they may have been active at a much later date in the lowlands.

BREEDING: The evidence at hand indicates that there are usually two litters during the breeding season—the first in June and the second in late August or September. Most of the females taken in June in the Susquehanna Valley, Bradford County, were lactating and nursing young. We began to catch well grown juveniles during the first

week in July. The data on embryos in the females examined are presented in the following table.

Date	*Number of embryos*	*Size*
1950, June 8	3	10 mm.
July 7	5	2 mm.
August 29	4	9 mm.

SPECIMENS TAKEN: 31—Bradford 15, Monroe 5, Pike 5, Sullivan 2, Susquehanna 2, Wayne 2.

WOODLAND JUMPING MOUSE

(Napaeozapus insignis insignis)

DISTRIBUTION: Occurs in suitable habitats throughout the region, but apparently not at lower elevations in the principal river valleys.

HABITAT: Cool, moist forest generally in stream valleys or the borders of lakes and swamps.

NOTES: The woodland jumping mouse is chiefly confined to local pockets in the cool, moist forests of the Canadian and Alleghenian zones. It seems to be quite partial to stream valleys, and most of our specimens were obtained in ravines, or the vicinity of mountain streams where there were thickets of rhododendron and a canopy of birches, maples, and various conifers. The habitat was almost invariably a rocky one.

The animals apparently go into hibernation sometime in October, and they generally do not resume their activities until sometime in May. We took our first specimens on May 17, 1950, in a stream valley near Kresgeville, Monroe County. This was at an altitude of only 800 feet, and it is doubtful that they had come out of hibernation on that date at higher elevations. The latest date on which we have taken it in the fall was on October 11, 1949, in the valley of Fishing Creek, at an elevation of about 1,200 feet.

BREEDING: Our observations seem to indicate that there are normally two litters a year—the first born in June or early July, and the second in late August or September. Data on embryos and placental scars in the females examined are presented in the following table.

Date	*Number of embryos*	*Size*	*Number of placental scars*
1949, September 28			6
1950, August 15			4
August 15	4	2 mm.	
August 16			5
August 16	5	7 mm.	
September 27			3
October 4			6

SPECIMENS TAKEN: 40—Bradford 1, Luzerne 5, Monroe 14, Pike 4, Sullivan 1, Susquehanna 8, Wayne 7.

CANADA PORCUPINE

(Erethizon dorsatum dorsatum)

DISTRIBUTION: Found in most of the extensively forested parts of the region.

HABITAT: Forested areas, particularly in stands of conifers or mixed stands of conifers and hardwoods. Most frequent in rocky areas or about rock ledges which provide the animal with suitable dens.

NOTES: Rhoads (1903) stated that the porcupine was numerous on North Mountain about a half century ago, but it was rare on the Pocono Plateau. We found it to be most aboundant in the North Mountain region, where we observed several individuals which had either been killed on the highways by cars or in the woods by hunters. Mr. William R. Ricketts, who makes his home near the shore of Ganoga Lake on the summit of the mountain, told us on September 21, 1950, that his hired man had recently killed twenty-six of these animals in the vicinity of his residence. Game Protector Philip Sloan, who at that time was residing near Mehoopany, Wyoming County, stated that they were just "too common" in that vicinity and that much damage was being done to apple trees by the animals. Elsewhere in the region the porcupine seems to be much less numerous, but there are definite indications that the population is on the increase.

Over most of the Pocono Plateau it seems to have been virtually unknown until comparatively recent years. Game Protector John Lohmann, of Milford, Pike County, says that a porcupine was considered to be a rarity in that county a decade or two ago, but that they are now becoming quite common. Rutledge found an abundance of porcupine sign along the river hills north of Equinunk, Wayne County, during October of 1950. The animals had well-beaten pathways among the rocks at the summit of the hills, and quills and scats were much in evidence. Farmers in the vicinity of Wyalusing, Bradford County, told us that the animals inhabit the river hills along the Susquehanna and that farm dogs had returned with their mouths full of porcupine quills.

The animal is generally destroyed whenever it is seen for it is extremely unpopular with foresters, farmers, and dog owners. But in spite of this, and the fact that normally but one young is produced annually, it has not only been holding its own but actually increasing in numbers.

FOOD HABITS: The bark of trees, and particularly that of the various conifers, is the animal's staple diet. An individual may spend hours, or even days, feeding in a tree. They seem to be quite fond of apples and may do great damage to the trees in an effort to get at the fruits.

SPECIMENS TAKEN: 1—Monroe 1.

VANISHED SPECIES

TIMBER OR GRAY WOLF

(Canis lupus lycaon)

In pioneer days the wolf was common throughout northeastern Pennsylvania. Between 1808 and 1820 a bounty of $5.00 was paid on wolves killed in Luzerne County. It is said that they were abundant in Tomhickon Valley between Catawissa and Hazleton as late as 1845. One was caught by Daniel Routan, near Prompton, Wayne County, in 1887. It was believed to have been chased from New York State by dogs. In Wyoming County, O. B. Vose caught one about 1870. (Rhoads, 1903.)

COUGAR, PANTHER, OR MOUNTAIN LION

(Felis concolor cougar)

The panther was a common inhabitant of the region during the time of its settlement. Between 1808 and 1820 Luzerne County paid a bounty on panther scalps, and it is said that upwards of 50 were killed in one year. Two were seen in Pike County in October 1873, and in Susquehanna County, the last one was killed near Clifford in 1874. (Rhoads, 1903.)

Persistent reports of the presence of panthers crop up periodically in this region, as in other parts of Pennsylvania, but all such reports thus far have proved unfounded.

CANADA LYNX

(Lynx canadensis)

According to Rhoads (1903), the Canada lynx always was a rare animal, even in the most boreal parts of the state. However, it appears to have been present throughout northeastern Pennsylvania during the early days. Rhoads states that one was killed in Columbia County by John M. Buckalew in 1849. Another was killed in Spring Brook Township, Lackawanna County, in September 1881. One of Rhoads' correspondents, Mr. G. D. Stevens, stated that it had been taken in Wayne County after 1890.

Mr. Harrison Slutter, a veteran wildcat hunter of the Poconos, states that he took two Canada lynx on the Pocono Plateau, in Monroe County, about the year 1926. They were both taken during the same week. One was taken in what is now the Pocono Lake Preserve, and the other between Brady's Lake and the Pocono Lake-Tobyhanna road. He submitted the pelts for bounty, and states that the identification was verified by officials of the Game Commission.

AMERICAN BISON OR BUFFALO

(Bison bison)

According to Rhoads (1903), the bison reached the Delaware Valley merely as a straggler. Fragments of a mandible were found among the remains of mammals in Hartman's Cave, near Stroudsburg, Monroe County, and teeth were found in deposits along the Susquehanna River at Pittston, Luzerne County.

AMERICAN ELK OR WAPITI

(Cervus canadensis canadensis)

The elk once roamed over this entire region. Rhoads (1903), however, states that it probably was never as numerous in the Poconos as in the central Allegheny Mountains. It was once common in Susquehanna County, where John Wrighter saw between 30 and 40 as late as 1820. The last one disappeared from the "Elk Forest" of Wayne County in 1839 or 1840. The last one was killed in Pike County not later than 1840 or 1845.

According to Gerstell (1936), 12 elk were released in Monroe County in 1912, the animals having been obtained from a private preserve in the same county. Twenty-four were released in Carbon County, and 6 more in Monroe County in 1915. He states that 4 legal bulls and 3 illegal or crop damage kills were made between 1913 and 1936. There have been no reports of elk in either Monroe or Carbon counties, or any of the counties of northeastern Pennsylvania, in more recent years.

MOOSE

(Alces americanus americanus)

According to Shoemaker (1947), there is historical evidence for the presence of the moose in Pennsylvania. "H. Hollister, in his inimitable 'History of the Lackawanna Valley' published in 1857, states that the moose from which the Moosic mountain range bordering the Lackawanna received its name were found there in great abundance. . . . It is said that at one time there were Moose Ponds in Susquehanna, Wayne, and Pike Counties." In addition, there is a Moosic Lake in Lackawanna County, and a town by the name of Moosic.

"During the exceptionally cold winters up to the last decade of the Eighteenth Century the moose moved southward out of their permanent abodes in the Adirondack wilderness, crossing the Mohawk River at some un-named point, and then followed the Catskill Mountains through Schoharie, Green, Ulster, and Sullivan Counties to Narrowsburg where they crossed the Delaware into Pennsylvania. From there they followed the main chain of the Allegheny Mountains in a southwesterly direction through Wayne, Lackawanna, Wyoming, Sullivan, Lycoming, Clinton, Centre, Clearfield, Blair, Cambria, Bedford, and Somerset Counties to the Maryland line . . . the extreme southern limit to their wanderings. However, there evidently was a regular migration route from Wayne County through Pike County . . . on through Monroe County to the Wind Gap of Northampton County."

AMERICAN MARTEN

(Martes americana americana)

The marten apparently no longer exists in the forests of northeastern Pennsylvania. A half century ago, however, correspondents of Rhoads stated that a few were still present in the North Mountain region in Wyoming and Columbia counties. In Wayne County it had by that time disappeared, although it was at one time plentiful.

FISHER

(Martes pennanti pennanti)

The fisher seems to have been exterminated in northeastern Pennsylvania more than a half century ago. Rhoads (1903) stated that two had been killed in Lackawanna County by Martin Creppen, of Olyphant, in 1885, and that one was caught in Oregon Township, Wayne County, by L. N. Goodnough in 1857. Mr. J. M. Buckalew, one of Rhoads' correspondents in Columbia County, stated that a few had been killed in that county in his memory.

CHANGES IN MAMMALIAN POPULATIONS

The following is a brief summary by species of recent changes in populations. The remarks about the small mammals are based on our observations and trapping success over the last two years. The statements made about the larger animals, game, furbearers, and predatory species, are based on our observations and on interviews with local hunters, trappers and District Game Protectors in combination with a study of the game kill reports and bounty records.

Game Animals

White-tailed Deer: The population is still too high in parts of the region, particularly in Pike County. A decline has been evident in recent years on parts of the Pocono Plateau, but deer are still numerous.

Black Bear: Population stable or showing a slight increase.

Varying Hare: An increase has been evident on the Pocono Plateau and in southern Pike County during recent years; elsewhere the species is uncommon with little change.

Cottontail Rabbits: No significant change has been noted in the population in recent years.

Gray Squirrel: No significant change has been noted in the population in recent years.

Woodchuck: Population apparently increasing in most sections.

Furbearers

Muskrat: Population generally low in recent years, but an evident increase was noted during the spring of 1951.

Mink: No appreciable change in the population for several years.

Weasels: Population has been decreasing for past two or three years.

Otter: Generally scarce and decreasing in numbers.

Foxes: Generally common but population much lower than it was a few years ago. Present population about stable or increasing slightly in some sections.

Bobcat: Population appears to be slowly increasing in well-forested areas.

Beaver: Population has evidently decreased in Carbon, Luzerne, and Monroe counties. It is stable or nearly so in other parts of the region.

Skunk: Population increasing slightly in most sections.

Opossum: Population increasing throughout the region.

Raccoon: Population stable or increasing slightly but fairly high in most sections. Low fur prices have in general offset the liberalization of seasons and bag limits.

Other Mammals

Porcupine: Increasing slowly and gradually extending its range.

Microtine Mice: Population generally low in recent years. There is some evidence that it is beginning to show an upward trend.

Flying Squirrels: Population, in general, rather low in recent years.

Chipmunks: Generally common to abundant in most suitable habitats but locally quite rare.

Deer Mice: Generally common, although there were some localities where these mice were quite scarce. Population at present probably somewhat below normal.

RABIES

Rabies, according to the dictionary, is "an infectious disease of the central nervous system", and is, "most common among meat eating animals." However, this sickness is not confined to carnivorous animals alone since cases frequently occur in sheep, cattle, and horses. Medical Science has perfected a serum for the prevention of rabies if administered within a limited time after exposure to the disease. It should be understood, however, that this is not a permanent preventive, and a new treatment must be made after each exposure to infection.

From records on file in the Game Commission offices at Harrisburg, Pennsylvania, in the form of "Positive Laboratory Reports," and reports of clinical diagnosis in the case of large domestic animals, it is evident that the greatest incidence of rabies occurs during the month of May. March and April show increases over the preceding winter months, and there is a decrease from July through September.

From time to time outbreaks occur in various sections of the state. During the period from 1943 through 1949, there were no cases reported in fifteen out of the sixty-seven counties in the state. Seventeen counties have reported from one to five cases of rabies during this same period. It appears that a little less than half the counties in the state have no rabies problem, and these are mainly counties with relatively small populations and diverse agricultural or forest products economies.

This report does not mean to imply that rabies is a disease peculiar to industrial and specialized agricultural areas, or areas of high populations. In such areas greater efforts are made to determine actual cases and prevent spread of the disease to humans in the area. There is little doubt that rabies occurs in all counties of the state, but, where light and scattered human populations exist, less effort to diagnose cases is made. This may, in large part, be the reason why there are no records from certain counties.

So far this discussion has been on a statewide basis. From this point we will consider the Northeast Sector of Pennsylvania and the rabies incidence of that section in particular. The Northeast Sector, as referred to in this discussion, includes thirteen counties: Bradford, Carbon, Columbia, Lackawanna, Luzerne, Monroe, Montour, Northumberland, Pike, Sullivan, Susquehanna, Wayne, and Wyoming.

In general the same conditions, with respect to rabies, prevail here as they do throughout the state. There are four counties reporting fewer than five cases of rabies from 1943 through 1950. These are Carbon, Monroe, Pike, and Sullivan counties. Again, it may be noted that these are counties with relatively light populations, having diverse agricultural and forest products economies. The two counties, Lackawanna and Luzerne, with greatest concentrations of population and industrial economies, report the greatest number of rabies cases. Luzerne County had 253 cases with peak years occurring in 1945 and 1946 in which 108 and 107 cases were reported. Lackawanna County is second with the same peak years in which 50 and 38 rabies cases were reported. Susquehanna County is third with the same two years being relatively high when 31 and 65 cases were reported. In 1947 all these counties reported fewer cases; and by 1948, Lackawanna reported 25 cases, Susquehanna 15 cases, and Luzerne 2 cases of rabies. In 1950 Susquehanna County took the lead with 57 cases reported. This indicated a serious outbreak there since only 5 cases had been reported the year before. Wayne County, in that year (1950) suddenly erupted with 34 cases of rabies. Its highest previous year was 1947 with five cases reported.

Conclusions: Rabies, or Hydrophobia, is of statewide occurrence and is not confined to carnivorous animals only.

Rabies appears to be mainly a warm weather malady.

The species known to be victims of rabies are in order of statewide occurrence: dog, cow, cat, sheep, hog, horse, fox, raccoon, rat, skunk, and muskrat.

In the Northeast Sector, the list of species in order of incidence is: dog, cow, cat, fox, raccoon, hog, and horse.

Rabies appears to reach epizootic proportions in various areas throughout the state but not in statewide waves. Peak years of occurrence differ in widely separated areas.

Some counties appear to be free of the disease while others tend to produce periodic or sporadic outbreaks of epizootic proportions.

Reported cases of rabies appear most numerous from areas of concentrated human populations, mainly large urban, industrial, and manufacturing areas. Such areas of high rabies incidence are Pittsburgh, Philadelphia, and the Anthracite Region.

Rabies should not be thought of as a disease peculiar to urban or industrial areas only. It can occur in all sections of the state.

Table 1. Incidence of Rabies in Pennsylvania

Year	*Overall State Incidence*	*Northeast Sector Incidence*
1940	344	?
1941	241	?
1942	346	?
1943	826	0
1944	902	16
1945	846	204
1946	503	236
1947	301	106
1948	147	45
1949	31	16
1950*	105*	96*
	4,592	719

? Total statewide figures on rabies incidence only for first three years as indicated. No breakdown by county available.

* Incomplete overall figures for last half of year indicated.

All records from Diagnostic Laboratory, Bureau of Animal Industry, Pennsylvania Department of Agriculture.

Table 2. Positive Cases of Rabies in Northeast Sector by Species

Year	*Dog*	*Cat*	*Cow*	*Hog*	*Sheep*	*Horse*	*Misc.*	*Total*
1943	0	0	0	0	0	0	0	0
1944	16	0	0	0	0	0	0	16
1945	173	8	23	0	0	0	0	204
1946	146	12	56	1	0	1	20	236
1947	76	8	15	0	0	0	7	107
1948	27	5	11	0	0	0	2	45
1949	4	0	7	0	0	0	3	14
1950	12	4	63	1	0	5	11	96
Total	454	37	175	2	0	6	43	717

Misc. Species listed under this heading in Northeast Sector are fox, (red and gray), and raccoon.

Overall State Totals by Species for Period 1943 Through 1950

Dog	*Cat*	*Cow*	*Hog*	*Sheep*	*Horse*	*Misc.*	*Total*
3,042	131	344	18	43	21	62	3,661

Misc. Species listed for state include fox (red and gray), raccoon, skunk, muskrat, and rat.

DATA AND REPORTS

The original data, field notes, and specimens on which this report is based have been deposited in the Section of Mammals, Carnegie Museum, Pittsburgh, Pennsylvania.

This report was prepared by William C. Grimm, Project Leader, and Ralph Whitebread, Assistant Project Leader.

CONCLUSIONS AND RECOMMENDATIONS

1. It is recommended that a long-term study of the white-tailed deer be undertaken on a statewide basis to determine the sex and age of the animals comprising the herd, the effect of local food conditions on the sex ratio of the fawns and the composition of the herd, and to collect other pertinent data.

2. It is recommended that the present law, which permits a minority group of individuals in any county to close that county to the hunting of antlerless deer, be abolished. Such a provision not only prevents the proper management of the deer herd, but it is detrimental to the interest of the farmers, orchardists, gardeners, and nurserymen.

3. It is recommended that greater protection be given to the otter in northeastern Pennsylvania, with a closed season until the animal can reestablish itself in sufficient numbers to warrant trapping.

4. It is recommended that greater encouragement be given the beaver on State Game Lands where it is desirable to establish areas for waterfowl, and that the animals be protected on such lands for said purposes as long as necessary.

5. It is recommended that the ineffective and outmoded bounty system be abolished, and that some other means be substituted to control predators whenever local control is deemed advisable. The employment of qualified professional trappers is suggested.

6. It is recommended that no campaign be undertaken to reduce wildlife populations in areas affected by a disease such as rabies, unless a strict quarantine is at the same time declared on dogs, cats, and other domesticated animals in the affected area, and that any control measures instituted be supervised by competent personnel.

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